Mathematica Link for Excel 3.6

User's Manual

&

Reference Guide

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Introduction

Overview

Mathematica Link for Excel consists of two main components:

The *ExcelLink* package.

The *MathematicaLink* add-in.

These components work together to provide full two-way connectivity between *Mathematica* and Excel.

To use the link from *Mathematica*, you load the *ExcelLink* package.

To use the link from Microsoft Excel, you load the *MathematicaLink* add-in.

Features

The *ExcelLink* package provides:

A set of *Mathematica* functions that allow you to:

- Read and write data to Excel ranges.
- Display graphics, typeset equations, and formatted output in Excel.
- Create, open, modify, and close Excel files.
- Develop Excel worksheet functions in *Mathematica.*
- Develop Excel macros in *Mathematica.*

The *MathematicaLink* add-in provides:

A set of worksheet functions that allow you to use *Mathematica* functions in Excel formulas.

A *Mathematica* Function Wizard to help you learn about and enter *Mathematica* functions.

A *Mathematica* macros window that allows you to turn *Mathematica* code into Excel macros.

A special Clipboard window that allows you to easily copy and paste data between programs.

A searchable PDF-based manual.

Changes

Version 3.5

New in Version 3.5

Compatibility with *Mathematica* 8.0.

Compatibility with Excel 2010 (including Excel 2010 64-bit version).

`ExcelShare` function allows sharing a kernel between Excel and *Mathematica*.

VBA support routines: `MathematicaSet`, `MathematicaRun`, and `MathematicaGet`.

Support for reading and writing Excel comments (including writing to a range using `CellLabel["my comment"]`).

Shift +click the *Mathematica* **Evaluate** button to close link and bring up the *Mathematica* connection window.

Shift +right-click a range to quickly display the *Mathematica* **Context** menu without turning on *Mathematica* Contexts.

Improved in Version 3.5

Updated toolbar and menu icons.

Improved *Mathematica* connection management (self-healing link, new connection options window).

Improved handling of *Mathematica* connection exceptions and evaluation interrupts.

Improved *Mathematica* messaging (messages now returned in real time).

Improved "Display Message Box" option now only applies to `Print[]` output.

Improved workbook initialization code evaluation and management.

Improved common multi-workbook initialization now supported using an *init.m* file in same directory.

Improved support for long-running *Mathematica* macros.

Improved automatic workbook relinking and addin startup logic.

Other minor improvements and fixes.

Version 3.2

New in Version 3.2

Compatibility with *Mathematica* 7.0 including *Mathematica* 7.0-based icons.

`ExcelOpen`, `ExcelSave`, and `ExcelDialog` support for Excel 2007 .xlsx, .xlsm, .xlsb files.

`ExcelWrite` support for writing `Grid[{{1, 2, 3}, {4, 5}, {6}}, opts]` f.ex. `ANOVATable` output.

`ExcelFormat[A:C, AutoFit]` to automatically adjust column width.

Support for 64-bit Windows and 64-bit *Mathematica* connecting to 32-bit Excel.

Improved in Version 3.2

Improved message print format in *Mathematica* 6 and 7.

Fixed a bug where some workbooks with macro buttons did not relink correctly.

Improved `ExcelInstall[Visible->True]` method for launching visible instance of Excel.

Improved *Mathematica* Macros dialog method of inserting of code boxes and buttons.

No "kernel connection closed" dialog if initialization code ends with `Quit[]`.

Other minor improvements and fixes.

Version 3.1

New in Version 3.1

Compatibility with *Mathematica* 6.0.

Compatibility with Excel 2007.

Keyboard shortcuts for Excel toolbar commands.

Additional Excel message-related options.

Restored backwards compatibility with Excel 2000.

Improved in Version 3.1

Improved editing of existing functions using the *Mathematica* Function Wizard.

Improved compatibility with workbooks originally built with version 2.x of the link.

Improved printable PDF documentation.

Version 3.0

New in Version 3

Display of typesetting and formatted output in Excel.

Creating *Mathematica*-based macros.

A suite of *Mathematica* functions to interact with and automate Excel.

Improved in Version 3

Start/End Link button is now an **Evaluate** button. This button can be used to interrupt current evaluations and re-evaluate the workbook once changes have been made. To end a link, hold down the Shift key and click the **Evaluate** button.

You can now use the Function Wizard to edit existing formulas, select and assign options more easily, and browse for built-in functions by category.

Standard packages are automatically declared by default and can be browsed directly within the Function Wizard. This functionality replaces the Libraries Dialog.

Data **Copy** and **Paste** commands are now available from a *Mathematica* Context Menu. You can now see the data you are copying and pasting using the *Mathematica* Clipboard window.

Kernel Dialog has now been incorporated into the *Mathematica* Clipboard window. You can type *Mathematica* expressions directly into the Clipboard window, evaluate them, and paste the results somewhere if you choose.

Messages are now displayed and stored to a nonmodal window. Using the window you can scroll through multiple messages, find the source of a message, and even save the messages to a log file.

Formula **Activate**/**Deactivate**/**Recalculate** commands are available from the *Mathematica* Context Menu as a **Comments** toggle and **Recalculate** command.

Increased worksheet function speed. Worksheet functions now calculate up to eight times faster.

Increased worksheet function reliability. Worksheet functions are now robust enough for the most demanding spreadsheet applications. Automated tests have performed billions of continuous evaluations without errors.

Improved worksheet function error handling. Dependent evaluations are now suppressed through the use of native Excel error codes.

To share workbooks with others, you can unlink the workbooks' formulas and macro buttons using the **Unlink** button in the *Mathematica* **Options ▸ Workbook** tab. If colleagues have the link, they will be automatically prompted to relink formulas when they open the workbook.

Strings and floating-point numbers can now be specified using the **DATA** worksheet function.

Obsolete in Version 3

The **MATH** worksheet functions provided in Version 2 have been superseded by a more flexible set of functions in Version 3. The **MATH** worksheet functions still work in Version 3. However, there may be slight differences in how results are returned.

If you would like to convert your existing formulas, here are examples of how they can be mapped.

Version 2	Version 3
=MATH("Inverse", A1:B2)	=EVAL("Inverse", A1:B2)
=MATHEXACT("Inverse", A1:B2)	=EVAL("InputForm", EXPR("Inverse", A1:B2))
=MATHVOLATILE("Random[]")	=CALC(EVAL("Random[]"))
=MATHDEFINE("m", A1:C3)	=EVAL("Set", "m", A1:C3)
=MATHCODE(B1:B10)	initialization code lives is a code box, no formula required
MATHFORMULA & CELL functions	experimental functions no longer supported

MATH function mappings.

The ReadExcel function has been superseded by a new suite of Excel functions. Here is an example of how an improved ReadExcel function could be defined using the new Excel functions.

```
ReadExcel[file_, sheet_, rng_] :=
 Module[{book, data},
  If[Not[ExcelCheck[ExcelBook[file]]], book = ExcelOpen[file]];
  data = ExcelRead[ExcelRange[file, sheet, rng]];
  If[ValueQ[book], ExcelClose[book]];
  data
 ]
```

This ReadExcel function checks to see if the required file is already open in Excel. If not it opens the file, reads the required data, and closes the book if it was not already open.

Working in *Mathematica*: Getting Started

Loading the Package

To start using the link from inside *Mathematica*, you must first load the *ExcelLink* package.

```
In[1]:= << ExcelLink`
```

The *ExcelLink* package provides a library of functions and symbols relating to Excel.

```
In[2]:= ?ExcelLink`*
```

ExcelLink`

Excel	ExcelFilter	ExcelRead	ExcelTypeset
ExcelActivate	ExcelForm	ExcelRefresh	ExcelUninstall
ExcelAddress	ExcelFormat	ExcelRename	ExcelUnshare
ExcelBook	ExcelGraphic	ExcelResize	ExcelWrite
ExcelBooks	ExcelInsert	ExcelResult	ImageFormat
ExcelCalculate	ExcelInstall	ExcelRun	MaxCharacters
ExcelCall	ExcelName	ExcelSave	ToExcel
ExcelCheck	ExcelNew	ExcelSelect	$ExcelDialogs
ExcelClear	ExcelObject	ExcelShape	$ExcelDirectories
ExcelClose	ExcelOffset	ExcelShapes	$ExcelGraphic
ExcelContext	ExcelOpen	ExcelShare	$ExcelLink
ExcelDate	ExcelOutput	ExcelSheet	$ExcelOutput
ExcelDelete	ExcelPosition	ExcelSheets	$ExcelResult
ExcelDialog	ExcelRange	ExcelSize	$ExcelShare
ExcelDirectory	ExcelRanges	ExcelStatus	$ExcelTypeset

You can learn more about these functions and symbols by looking up its entry in the *Mathematica* Reference section of this information. You can also access this information within *Mathematica*'s help system by looking under `Add-Ons`.

Assigning and Retrieving Data

```
In[1]:= Needs["ExcelLink`"]
```

The top-level `Excel` function provides an easy way to specify a location in Excel, as if it were a variable, then assigns or retrieves data from it.

```
In[2]:= Excel["A1"] = "hello"

In[3]:= Excel["A1"]
Out[3]= hello
```

You can also clear data from the Excel location.

```
In[4]:= Excel["A1"] =.
```

When assigning data to Excel ranges, one-dimensional data can be assigned either to single rows or single columns of cells.

```
In[5]:= Excel["A1:C1"] = {1, 2, 3}
```

```
In[6]:= Excel["A1:A3"] = {1, 2, 3}
```

Two-dimensional data can be assigned to a rectangular range of cells.

```
In[7]:= Excel["A1:C3"] = {{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}
```

```
In[8]:= Excel["A1:C3"] =.
```

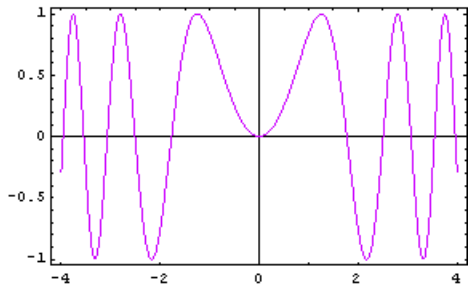
Displaying Graphics

```
In[1]:= Needs["ExcelLink`"]
```

This displays a graphic in *Mathematica.*

```
In[2]:= g = Plot[Sin[α^2], {α, -4, 4}, PlotStyle → Hue[.8], Frame → True]
```

From In[2]:=



This displays the same graphic in Excel.

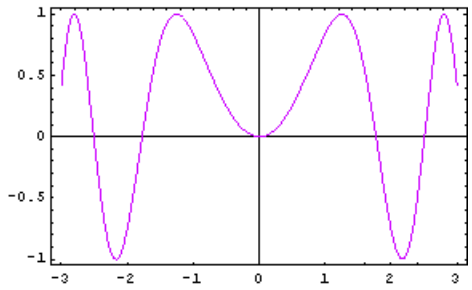
```
In[3]:= Excel["B3"] = g
```

As specified, the graphic is displayed at cell B3. This cell will serve as an anchor point for the graphic; however, you can move it anywhere you like. You can also resize the graphic as needed.

Subsequent assignments update and redraw the existing graphic.

```
In[4]:= g = Plot[Sin[α^2], {α, -3, 3}, PlotStyle → Hue[.8], Frame → True]
```

From In[4]:=




```
In[5]:= Excel["B3"] = g
```

This clears the graphic associated with cell B3.

```
In[6]:= Excel["B3"] =.
```

Displaying Expressions

```
In[1]:= Needs["ExcelLink`"]
```

This defines an expression to be displayed.

```
In[2]:= expr = Sin[i Pi]^2 / 2;
```

Here is a typeset form of the expression.

```
In[5]:= TraditionalForm[expr]
```

```
Out[5]//TraditionalForm=
```

$$-\frac{1}{2}\sin^2(i\,\pi)$$

This displays the typeset form in Excel.

```
In[6]:= Excel["B3"] = TraditionalForm[expr]
```

This clears the displayed expression associated with cell B3.

```
In[7]:= Excel["B3"] =.
```

Working in *Mathematica*: General Principles

Function Overview

Functions in the *ExcelLink* package follow the general convention:

```
Excel[Method][Excel[Object][ ...], ...]
```

Four kinds of Excel objects are supported. Here is a list of the objects with some methods that apply to them.

Book: *New, Open, Refresh, Save, Close.*

Sheet: *Insert, Rename, Delete, Activate.*

Range: *Read, Write, Clear, Resize, Offset, Filter, Select.*

Shape: *Insert, Rename, Delete, Read, Write, Select.*

For detailed information on all the objects and methods provided by the *ExcelLink* package, see the *Mathematica* Reference section.

Shorthand Notation

Objects

Most objects in Excel can be referenced directly by a unique identifier. The identifier is typically the name of an object or, in the case of ranges, the address. If an identifier is unique among all object types, you do not need to specify what kind of object it is.

Here a range object is provided as a typed object.

```
ExcelRead[ExcelRange["A1:B10"]]
```

Here the range object is specified only by its address; the identifier implicitly identifies it as a range.

```
ExcelRead["A1:B10"]
```

You can use this type of shorthand referencing in any function that requires an Excel object.

Methods

Read and write operations are so common, a shorthand has also been provided for them, and for clearing a range.

```
In[1]:= Needs["ExcelLink`"]

In[2]:= Excel["A1:B10"] = Table[Random[], {10}, {2}]

In[3]:= Excel["A1:B10"]

Out[3]= {{0.395543, 0.335494}, {0.934515, 0.304868}, {0.495912, 0.426754},
         {0.657647, 0.398919}, {0.800834, 0.159929}, {0.216486, 0.109539}, {0.694347, 0.157112},
         {0.0578395, 0.273708}, {0.750935, 0.710237}, {0.760348, 0.420566}}

In[4]:= Excel["A1:B10"] =.
```

The above three lines of shorthand code are equivalent to the following.

```
In[5]:= ExcelWrite[ExcelRange["A1:B10"], Table[Random[], {10}, {2}]]

In[6]:= ExcelRead[ExcelRange["A1:B10"]]

Out[6]= {{0.779186, 0.105253}, {0.954368, 0.320287}, {0.383643, 0.769759},
         {0.0198529, 0.0154194}, {0.887731, 0.343005}, {0.362206, 0.6165},
         {0.0868974, 0.183076}, {0.14572, 0.506961}, {0.39255, 0.025964}, {0.0878807, 0.233253}}

In[7]:= ExcelClear[ExcelRange["A1:B10"]]
```

Notes

- If more than one object has the same identifier (e.g. a shape has the same name as a sheet) the identifier most likely to be used by the calling method is returned.

Object Notation

Using full object notation can be useful when referring to an object by index, or providing context for the object.

Here are a few examples.

```
ExcelSheet[1]
ExcelSheet["Book1", "Sheet1"]
ExcelSheet["Book1", 1]
ExcelRange["Report.xls", 1, "A1:D100"]
```

When no context is provided, the active context is assumed.

Excel object references are resolved when they are passed to a method, not before. Until then, they are just *Mathematica* expressions representing a location in Excel.

```
In[1]:= Needs["ExcelLink`"]

In[2]:= ExcelSheet["My Sheet"]

Out[2]= -Sheet: My Sheet-

In[3]:= ExcelRead[ExcelSheet["My Sheet"]]

        ExcelRead::source : -Sheet: My Sheet- is not a valid range, shape, or sheet.

Out[3]= $Failed
```

If you want to see if an object reference is valid, you can do so by using the `ExcelCheck` function.

```
In[4]:= ExcelCheck[ExcelSheet["My Sheet"]]

Out[4]= False
```

You can return collections of objects as a list by using the plural of an object name.

```
In[5]:= ExcelSheets[]

Out[5]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}
```

You can extract the name of a returned object.

```
In[6]:= ExcelName[First[ExcelSheets[]]]

Out[6]= Sheet1
```

You can also return the embedded context information for the objects.

```
In[7]:= ExcelContext[First[ExcelSheets[]]]
Out[7]= {Book1}
```

Expression Cells

If the Number Format of an Excel cell is set to Text, the contents of the cell are considered to be a *Mathematica* expression when transferring them to *Mathematica* via the clipboard or in a macro.

For more information, see Strings in the Excel Reference guide.

Notes

- Cells should be formatted as Text *before* entering an expression. To convert existing contents to Text, you can reenter them manually or use the provided **Expression** command from the *Mathematica* Context menu.
- Expressions such as $1/2$ or $-x$ can *only* be entered in cells formatted as Text. Otherwise, Excel will attempt to interpret them as something else.
- When working with expression cells, all cells in the range should be formatted as Text. *Partial* expression ranges are not currently supported.
- From *Mathematica*, you can use the `ExcelFormat` function to apply or unapply Text format to a range.

Data Cells

If the Number Format of an Excel cell is *anything other than* Text, the cell is considered a data cell.

When transferring the contents of data cells from Excel to *Mathematica*:

Data is transferred as it is natively stored in Excel. This means, for example, all numbers will be returned as floating-point doubles. This includes dates that are numbers with special formatting properties.

When transferring *Mathematica* expressions to Excel data cells:

Nonnative expressions are converted to an equivalent Excel data type whenever possible. Expressions that do not have any possible Excel-equivalent are converted to `InputForm` strings.

See the Data Types Overview for more details.

Notes

- You can use the `ExcelDate` function and `ExcelForm` functions to work with date values once you get them into *Mathematica*.
- Cell references in Excel-based formulas such as =EVAL(A1,A2,A3) are an exception to this rule. In this case, you must wrap formula arguments with the provided DATA function to treat them as data cells; =EVAL("StringJoin", DATA(A2), DATA(A3)), for example.

Automating Excel

Opening Excel

By default, the *ExcelLink* package automatically connects, as needed, to an open instance of Excel. This provides easy, on-demand connectivity. In this mode, you can open or close Excel on your own whenever you wish.

If you write *Mathematica* code that automates Excel to perform a task, you may want the *Mathematica* code to initiate opening an instance of Excel. The `ExcelInstall` function provides a way of doing this.

```
In[1]:= Needs["ExcelLink`"]
```

This opens a visible instance of Excel, if one is not already open.

```
In[2]:= ExcelInstall[Visible → True]

Out[2]= LinkObject[C:\Documents and Settings\Anton\Application
          Data\Mathematica\Applications\ExcelLink\Binaries\ExcelLink.exe, 2, 2]
```

Once an Excel automation routine has been developed, you can set `Visible -> False` instead. This will open a hidden, private instance of Excel to perform the requested tasks.

Importing Workbooks

```
In[1]:= Needs["ExcelLink`"]
```

This specifies a file to import data from.

```
In[2]:= f = ToFileName[{ExcelDirectory["Link"], "Examples"}, "Stocks.xls"]

Out[2]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Examples\Stocks.xls
```

This opens the file.

```
In[3]:= ExcelOpen[f]

Out[3]= -Book: Stocks.xls-
```

This returns the sheets in the file.

```
In[4]:= ExcelSheets[]

Out[4]= {-Sheet: IBM-, -Sheet: CSCO-, -Sheet: AAPL-, -Sheet: MSFT-, -Sheet: BLDP-,
          -Sheet: AIG-, -Sheet: ADP-, -Sheet: JNJ-, -Sheet: SYY-, -Sheet: WMT-}
```

This reads in all the data from one of the sheets.

```
In[5]:= data = ExcelRead[ExcelSheet["IBM"]];
```

This previews the first five rows of data from the sheet.

```
In[6]:= Take[data, 5]

Out[6]= {{Date, Open, High, Low, Close, Volume, Adj. Close},
         {36886., 88.97, 89.53, 82.14, 85., 6.0523×10^6, 84.47},
         {36878., 88.39, 94.41, 80.07, 89., 7.6938×10^6, 88.45},
         {36871., 96.49, 98.23, 87.32, 87.81, 6.1856×10^6, 87.27},
         {36864., 96.01, 104.74, 93.13, 97., 5.5668×10^6, 96.4}}
```

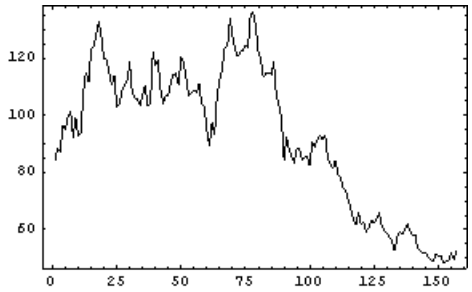
This defines the data in the last column.

```
In[7]:= adjclose = Rest[Part[data, All, -1]];
```

This plots the data.

```
In[8]:= ListPlot[adjclose, Joined → True, Frame → True, Axes → False]
```

From In[8]:=



This closes the workbook once you are finished importing data from it.

```
In[9]:= ExcelClose[]
```

Exporting Workbooks

```
In[1]:= Needs["ExcelLink`"]
```

You can provide any format to an exported workbook by referencing an existing template file.

This specifies an existing template file to use for exporting the file.

```
In[2]:= f = ToFileName[{ExcelDirectory["Link"], "Templates"}, "Report.xls"]
Out[2]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Templates\Report.xls
```

This creates the new workbook based on the template file.

```
In[3]:= ExcelNew[f]
Out[3]= -Book: Report1-
```

The template contains a named range that defines where to put data in the report.

```
In[4]:= ExcelRanges[]
Out[4]= {-Range: Trials_Range-}
```

It also contains a named shape to display a graphic.

```
In[5]:= ExcelShapes[]
Out[5]= {-Shape: Histogram Graphic-}
```

This simulates rolling two six-sided dice 500 times.

```
In[6]:= roll := Random[Integer, {1, 6}]
        trials = Table[roll + roll, {500}];
```

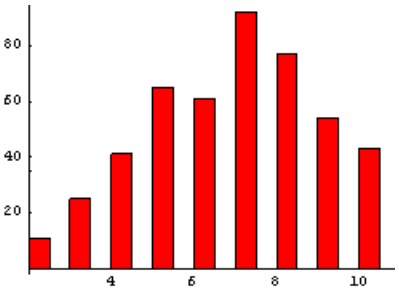
This writes the trial data to the report.

```
In[8]:= ExcelWrite["Trials_Range", trials]
```

This displays a histogram to the named shape.

```
In[9]:= If[$VersionNumber < 7, If[$VersionNumber ≥ 6, Needs["Histograms`"], Needs["Graphics`"]]]
        ExcelWrite["Histogram Graphic", Histogram[trials]]
```

From In[9]:=



This defines the file name for the report workbook.

```
In[11]:= f = ToFileName[{ExcelDirectory["Home"]}, "Autogenerated Report.xls"]
Out[11]= C:\Documents and Settings\Anton\My Documents\Autogenerated Report.xls
```

This saves the report workbook to disk.

```
In[12]:= ExcelSave[Active, f]
Out[12]= -Book: Autogenerated Report.xls-
```

This closes the workbook once you have finished exporting data to it.

```
In[13]:= ExcelClose[]
```

This cleans up by deleting the exported workbook file.

```
In[14]:= DeleteFile[f]
```

Closing Excel

```
In[1]:= Needs["ExcelLink`"]
```

Once your automation routines are completed, you can use the `ExcelUninstall` function to close Excel.

```
In[2]:= ExcelUninstall[]
```

By default, `ExcelUninstall` only closes visible instances of Excel if no workbooks remain open. This avoids accidental data loss. You can force a visible instance of Excel to close, even if workbooks are open, by specifying `Visible -> True` as an option to `ExcelUninstall`.

Creating Excel Functions

Defining Functions

Here is how to define a *Mathematica* function that adds two numbers.

```
In[1]:= addtwo[x_, y_] := x + y
```

Arguments for the function are specified using `pattern _` indicators. The delayed assignment `:=` operator indicates that the body of the function is evaluated only once the values for the arguments are known.

```
In[2]:= addtwo[2, 2]
Out[2]= 4
```

The next example uses a function defined in a standard package, which you must load first.

```
In[3]:= If[$VersionNumber >= 6, Needs["ComputationalGeometry`"], Needs["DiscreteMath`ComputationalGeometry`"]]
```

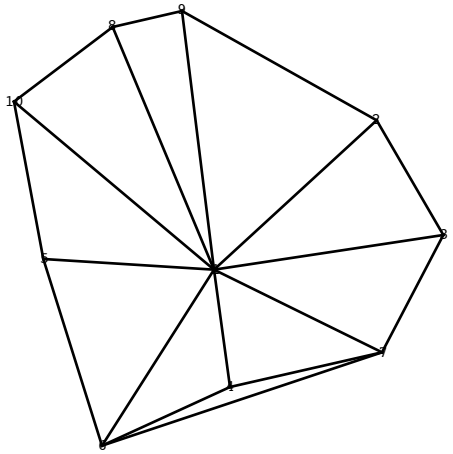
This is an example of a function that generates a graphic.

```
In[4]:= triplot[n_] := PlanarGraphPlot[Table[Random[], {n}, {2}]]
```

The function triangulates a set of n random coordinates.

```
In[5]:= triplot[10]
```

From In[5]:=



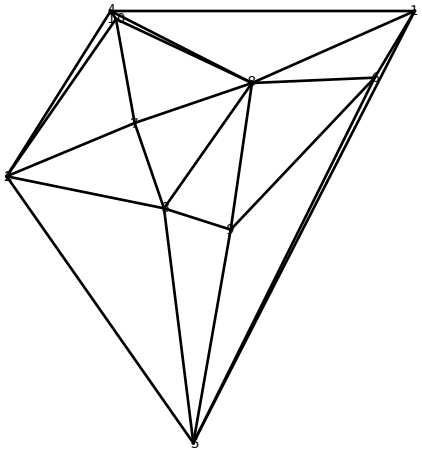
Here is a version of the same function, written in two steps.

```
In[6]:= triplot[n_] :=
         Module[{data},
          data = Table[Random[], {n}, {2}];
          PlanarGraphPlot[data]
         ]
```

In this definition, a local variable is defined within the body of the function. The two steps within the body of the function are separated using a semicolon. The final line of code returns the value of the function.

```
In[7]:= triplot[10]
```

From In[7]:=



Special Considerations

Usage

To help others know how to use your function, you can define a usage message.

```
In[8]:= triplot::"usage" = "triplot[n] plots a random triangulation of n planar points."
Out[8]= triplot[n] plots a random triangulation of n planar points.
```

The usage message is used by the *Mathematica* Function Wizard to automatically generate argument templates for the function. To be fully compatible with the Function Wizard, you should always use the following convention for your usage messages.

```
In[9]:= f::"usage" = "f[x] does one thing. f[list] does another. f[list, x] does more."
Out[9]= f[x] does one thing. f[list] does another. f[list, x] does more.
```

Options

You can also define a set of default options for your functions, if needed.

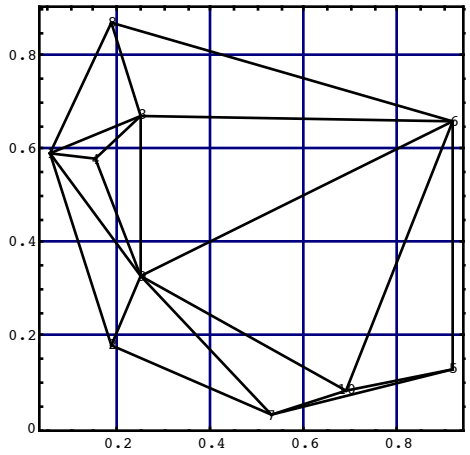
```
In[10]:= Options[triplot] = {Frame → False, GridLines → None}
Out[10]= {Frame → False, GridLines → None}
```

This clears the previous definition for the function, then defines it with options.

```
In[11]:= Clear[triplot]

In[12]:= triplot[n_, opts___Rule] :=
          Module[{data, g, rules},
           data = Table[Random[], {n}, {2}];
           rules = Sequence @@ Join[{opts}, Options[triplot]];
           PlanarGraphPlot[data, rules]
          ]
```

```
In[13]:= triplot[10, Frame → True, GridLines → Automatic]
```

From In[13]:=



Errors

When you are developing a function that will be used in Excel, you should consider returning the symbol `$Failed` if something goes wrong in your function. You can do this using the `Check` function.

```
In[14]:= triplot[n_, opts___Rule] :=
          Check[Module[{data, g, rules},
            data = Table[Random[], {n}, {2}];
            rules = Sequence @@ Join[{opts}, Options[triplot]];
            PlanarGraphPlot[data, rules]
           ], $Failed]
```

The symbol `$Failed` is converted to a `#VALUE!` error in Excel that will suppress further dependent calculations.

```
In[15]:= triplot["hello"]

          Table::iterb : Iterator {hello} does not have appropriate bounds. More…

Out[15]= $Failed
```

To be complete, you should also create a catch-all function definition that will handle the case where users provide arguments that do not match the pattern you specified. By default, the function returns unevaluated.

```
In[16]:= triplot[1, 2, 3]

Out[16]= triplot[1, 2, 3]
```

This traps the error.

```
In[17]:= triplot[___] := $Failed

In[18]:= triplot[1, 2, 3]

Out[18]= $Failed
```

You can also create your own error messages to inform the user about what went wrong.

```
In[19]:= triplot[___] :=
          Module[{},
           Message[triplot::"args"];
           $Failed
          ]

In[20]:= triplot::"args" = "Arguments are incorrect"

Out[20]= Arguments are incorrect
```

```
In[21]:= triplot[1, 2, 3]

         triplot::args : Arguments are incorrect

Out[21]= $Failed
```

Code Box Deployment

Once you have developed a set of *Mathematica* functions you would like to use in Excel, you can collect cells that define the functions in one place to make it easier to transfer the code to Excel.

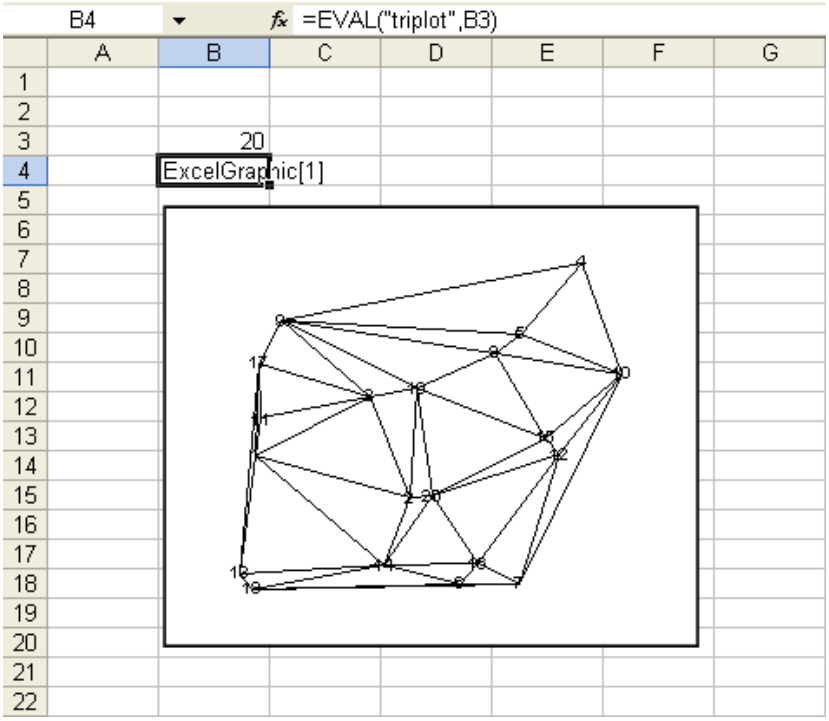
```
In[1]:= If[$VersionNumber >= 6, Needs["ComputationalGeometry`"], Needs["DiscreteMath`ComputationalGeometry`"]]

In[2]:= Clear[triplot]

In[3]:= triplot::"usage" = "triplot[n] plots a random triangulation of n points.";

In[4]:= Options[triplot] = {Frame → False, GridLines → None};

In[5]:= triplot[n_, opts___Rule] :=
         Check[Module[{data, g, rules},
           data = Table[Random[], {n}, {2}];
           rules = Sequence @@ Join[{opts}, Options[triplot]];
           PlanarGraphPlot[data, rules]
          ], $Failed]

In[6]:= triplot[___] :=
         Module[{},
          Message[triplot::"args"];
          $Failed
         ]

In[7]:= triplot::"args" = "Arguments are incorrect";
```

To deploy this code as an Excel function, you will need to copy the contents of the notebook cells that define the function to an initialization code box in an Excel workbook.

Here is how to do this.

1. Create an initialization code box in Excel:
    - Click **Macros** on the *Mathematica* Toolbar.
    - Click **New...** and name the macro Initialization. This is the default if no other macros exist in your workbook.
    - Select a location for the code box and click **OK**.
2. Copy the code from *Mathematica*:
    - Use **Kernel ▸ Show In/Out Names** to temporarily hide input labels.
    - Select the Input cells to copy. To select noncontiguous cells, hold down the Ctrl key.
    - Press Ctrl + C or choose **Edit ▸ Copy**.
3. Paste the *Mathematica* code into the Excel code box:
    - Click and drag inside the code box to select all existing contents.
    - Press Delete to delete the previous contents.
    - Press Ctrl + V or choose **Edit ▸ Paste**.

You can now use the *Mathematica* function you created inside Excel.



Notes

Using the code box approach, you can create workbooks that have no dependencies on other files.

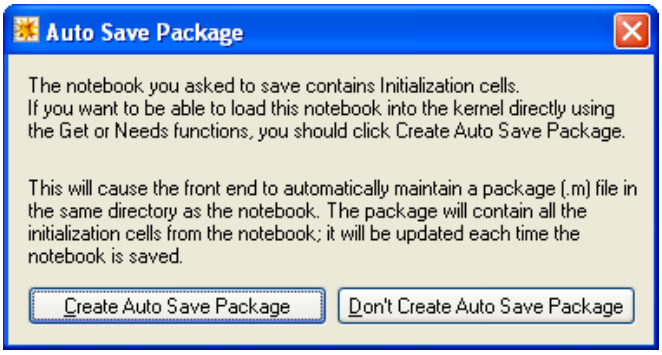
Package Deployment

Mathematica notebooks can automatically generate an associated package file. This provides an easy way for you to export a set of *Mathematica* function definitions you would like to use in an Excel workbook.

With this in mind, on the Excel side, the *MathematicaLink* add-in checks for a package file with the same name in the same directory when initializing a workbook. If one is found, the code in the file is considered the initialization code for the workbook.

Here is how to create a package file from a notebook, then use the contents of the package file as initialization code in a workbook:

- Create .nb and .xls files with the same name in the same directory.
- Select the cells that contain code that will be used in the workbook.
- Click **Cell ▸ Cell Properties ▸ Initialization Cell** to specify the selected cells as initialization cells.
- Save the notebook. When you do this, you will be prompted to create a package file with the contents of the initialization cells.
- Click **Create Auto Save Package**.


Auto Save Package
The notebook you asked to save contains Initialization cells.
If you want to be able to load this notebook into the kernel directly using the Get or Needs functions, you should click Create Auto Save Package.
This will cause the front end to automatically maintain a package (.m) file in the same directory as the notebook. The package will contain all the initialization cells from the notebook; it will be updated each time the notebook is saved.
Create Auto Save Package
Don't Create Auto Save Package

You should now have .nb, .m, and .xls files in the same directory with the same name. In the future, every time you save changes to the notebook, the package file is automatically updated. In turn, the next time you evaluate in Excel, the new set of function definitions will be automatically loaded and used.

Notes

- Using the package approach, you can easily develop and update function definitions for a workbook. However, you must remember to send the package file along with the workbook to enable others to interact with the workbook.
- During development, be sure to save changes to your *Mathematica* notebook in order to update the package file before using it from the Excel side.

Creating Excel Macros

Developing Macros

Setting Up a New Notebook

When developing *Mathematica* code, it is best to separate input and output definitions from the main analysis portion of the routine. This way your analysis code can be easily adapted to obtain inputs and send outputs anywhere.

Here is a sequence of *Mathematica* commands that performs some analysis.

This section defines inputs.

```
In[1]:= m = {{1., 2.}, {3., 4.}};
```

This section performs your analysis.

```
In[2]:= m = Inverse[m];
```

This section displays outputs.

```
In[3]:= m
Out[3]= {{-2., 1.}, {1.5, -0.5}}
```

To use this code as an Excel macro, you only need to load the *ExcelLink* package to modify the input and output sections. Before doing this, open Excel and type in the same inputs into the workbook locations indicated in the following.

This section loads required packages.

```
In[4]:= Needs["ExcelLink`"]
```

This section defines inputs from Excel.

```
In[5]:= m = Excel["B3:C4"];
```

This section performs your analysis.

```
In[6]:= m = Inverse[m];
```

This section returns outputs to Excel.

```
In[7]:= Excel["B3:C4"] = m
```

In this example, the input and output range is the same. This is a way of performing in-place evaluation.

Modifying an Existing Notebook

To convert an existing *Mathematica* notebook to be used as an Excel macro:

- Locate the cells in your notebook that define inputs to your analysis.
- Modify those cells to use values contained in Excel.
- Likewise, locate the cells in the notebook that display outputs of your analysis.
- Modify those cells to return results to Excel.

For more information, see Code Box Deployment.

Special Considerations

Status

If your analysis takes a while to complete, you may want to provide some feedback to the user on how the analysis is proceeding. You can do this by using the `ExcelStatus` function.

```
In[1]:= Needs["ExcelLink`"]

In[2]:= ExcelStatus["Processing data..."];
        Pause[3];
        ExcelStatus["Analyzing data..."];
        Pause[5];
        ExcelStatus["Generating report..."];
        Pause[1];
        ExcelStatus[];
```

This writes status information to the status bar at the bottom left-hand side of the Excel window. In the final line `ExcelStatus` is called without arguments in order to return the status bar to its default state.

Notes

- Writing status messages makes the analysis section of your notebook Excel specific. However, this may be required for longer routines.
- Writing status messages can also be a good way to see which part of your analysis is taking up the most time.

Dialogs

If you would like to ask the user to select a range or specify a file name during a macro, you can do so using the `ExcelDialog` function. The symbol `$ExcelDialogs` gives a list of available dialogs.

```
In[9]:= $ExcelDialogs
Out[9]= {Range, Open, Save, Files, Folder}
```

This displays the `" Range "` dialog.

```
In[10]:= ExcelDialog["Range"]
Out[10]= -Range: B3:C4-
```

Notes

- When running code from *Mathematica*, you need to activate Excel first to interact with an Excel dialog.

Notebook Deployment

When developing Excel macros, you do not need to transfer code to a workbook. The *Mathematica* code can remain stored in a notebook file. In this case, any time you want to run a macro on a particular Excel workbook, open the notebook that contains the macro and, with the workbook open in Excel, evaluate the code from the notebook.

Code Box Deployment

To create a standalone workbook interface, you can transfer the *Mathematica* macros you have developed in a notebook to code boxes in the Excel workbook. Once this is done you can create buttons for the macros.

To deploy *Mathematica* code as an Excel macro you will need to copy the notebook cells that define the macro to a code box in an Excel workbook.

Here are the notebook cells that contain the code you want to use as a macro.

```
In[1]:= Needs["ExcelLink`"]

In[2]:= m = Excel["B3:C4"];

In[3]:= m = Inverse[m];

In[4]:= Excel["B3:C4"] = m
```

Here is how to transfer the code to Excel.

1. Create a code box for the macro in Excel:

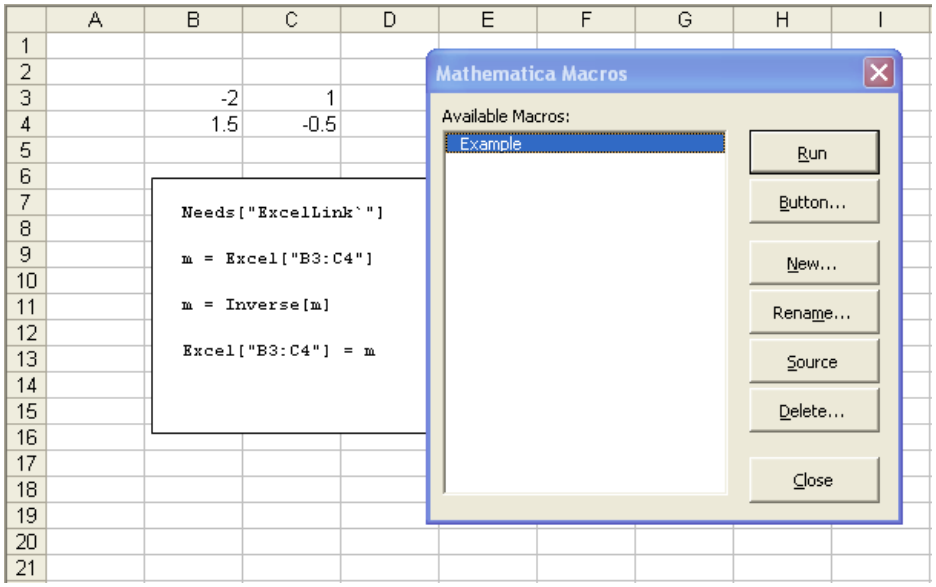
   - Click **Macros** on the *Mathematica* Toolbar.
   - Click **New...** and name the macro whatever you like. Spaces in the macro name are permitted.
   - Select a location for the code box and click **OK**.

2. Copy the code from *Mathematica*:

   - Use **Kernel ▸ Show In/Out Names** to temporarily hide input labels.
   - Select the cells to copy. To select noncontiguous cells, hold down the **Control** key.
   - Press Ctrl + C or choose **Edit ▸ Copy**.

3. Paste the *Mathematica* code into the Excel code box:

   - Click inside the code box you just created.
   - Click and drag to select all existing contents of the code box.
   - Press **Delete** to delete the previous contents.
   - Press Ctrl + V or choose **Edit ▸ Paste**.



To create a button for the *Mathematica* macro:

- Select the name of the macro from the Available Macros list.
- Click **Button...** .
- Select a location for the button and click **OK**.

For more information on using macros you create in Excel, see Working with Macros.

Notes

- When running macro code from inside Excel, it is not necessary to load the *ExcelLink* package. However, you can still include the line in your macro.
- Using the code box approach, you can create workbooks that have no dependencies on other files.

Package Deployment

Mathematica notebooks can automatically generate an associated package file. This provides an easy way to export a set of *Mathematica* commands that can be used as a one-click workbook processing macro.

To create a package file, follow the steps outlined for creating a package file outlined in the "Package Deployment" section of Creating Excel Functions. The only difference is, in this case, you will save a sequence of macro commands to the package file instead of a set of function definitions.

You should now have .nb, .m, and .xls files in the same directory with the same name. In the future, every time you save changes to the notebook, the package file is automatically updated. In turn, the next time you click **Evaluate** in Excel, the new workbook processing macro will be used.

Notes

- If you would like the kernel to close after workbook processing is complete, include `Quit []` as the last line of your macro.

Working in Excel: Getting Started

Loading the Add-in

After installing the link, you will see a *Mathematica Link for Excel* folder in your **Start ▸ All Programs** menu. The add-in in this folder is required if using the link from the Excel side or when copying and pasting data between programs.

The *Mathematica Link for Excel* start menu folder.

If you did not install the add-in when you installed the software, click ***Mathematica Link* Add-In** to do so now. The add-in will install itself when it is loaded the first time. This may take a moment depending on your anti-virus/ security settings.

If you are prompted to do so, choose to **Enable Macros** in the security warning dialog. If no dialog appears and nothing works, you may need to adjust your Excel macro security settings to permit the macros in the add-in to run. Refer to the Help menu in your version of Excel regarding how to change your macro security settings. Once you have adjusted your security settings, close Excel and try loading the add-in again.

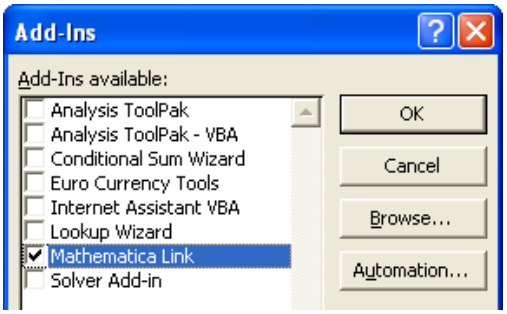
Once the add-in is loaded, the *Mathematica* toolbar will appear.

- In Excel 2007 or later, the *Mathematica* toolbar can be found under the **Add-Ins** ribbon tab.

The *Mathematica* toolbar.

If you would like a *Mathematica* menu instead, you can click the **Options** button on the toolbar. All commands in the *Mathematica* menu are identical to those on the *Mathematica* toolbar. The *Mathematica* menu can be useful if you would like to use the Alt key to access menu-based commands.

Once you have installed the add-in the first time, you no longer need to use the **Start** menu shortcut. Instead, you can use **Tools ▸ Add-ins** dialog to load or unload the *Mathematica Link* add-in. Excel checks the settings in this dialog each time it starts and automatically loads any checked add-ins.



The Excel add-ins manager.

- To access the add-ins manager in Excel 2007 or later, click the **Office** button / **File** menu to the upper-left corner, click **Excel Options**, then under **Add-ins,** next to the **Manage: Excel Add-ins** dropdown box, click **Go...**.

Entering a Function

Once the *Mathematica Link* add-in is loaded, you are ready to perform *Mathematica* calculations inside Excel. One way of doing this is using the **EVAL** worksheet function. This worksheet function allows you to call any *Mathematica* function from within an Excel formula.

Try entering the simple *Mathematica* function `Prime` in an empty worksheet cell. This is done as shown.

Formula	Result
=EVAL("Prime",100)	541

The value returned is the 100^{th} prime number.

- International verisons of Excel may require semicolon-separated formulas such as =EVAL("Prime"; 100).
- During your first calculation, a *Mathematica* kernel will be launched as a computation server for Excel. This new process may appear in your Windows task bar.

Now, try creating an interactive prime number calculator by specifying a cell reference as an argument.

Formula	Result
=EVAL("Prime",A1)	#N/A

Unless you have already entered a value in cell `A1`, the function returns unevaluated and displays an error code. The `#N/A` error code indicates that one or more inputs to the formula are not available.

Type any integer you choose in cell `A1`, and a prime number will be calculated for you.

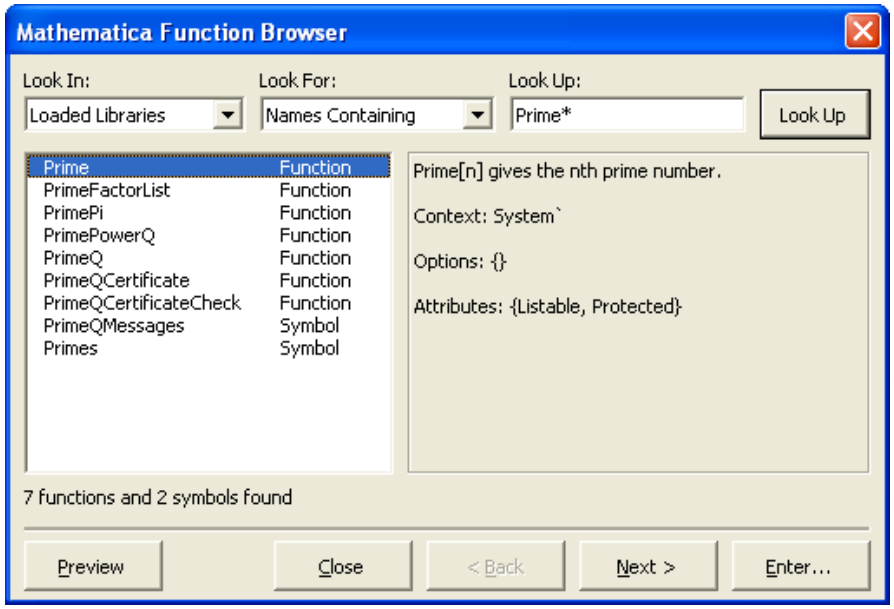
Here are some other examples.

Formula	Result
=EVAL("Factorial",10)	3628800
=EVAL("Det",A1:C3)	determinate of matrix in cells A1:C3
=EVAL("Expand","(x+1)^3")	1 + 3 * *x* + 3 * *x* ^ 2 + *x* ^ 3
=EVAL("Plot","x^2","{x,0,5}")	`ExcelGraphic[1]`

Mathematica contains thousands of functions. If you know precisely which *Mathematica* function you wish to use and the arguments it takes, you can type it directly into your spreadsheet, as shown.

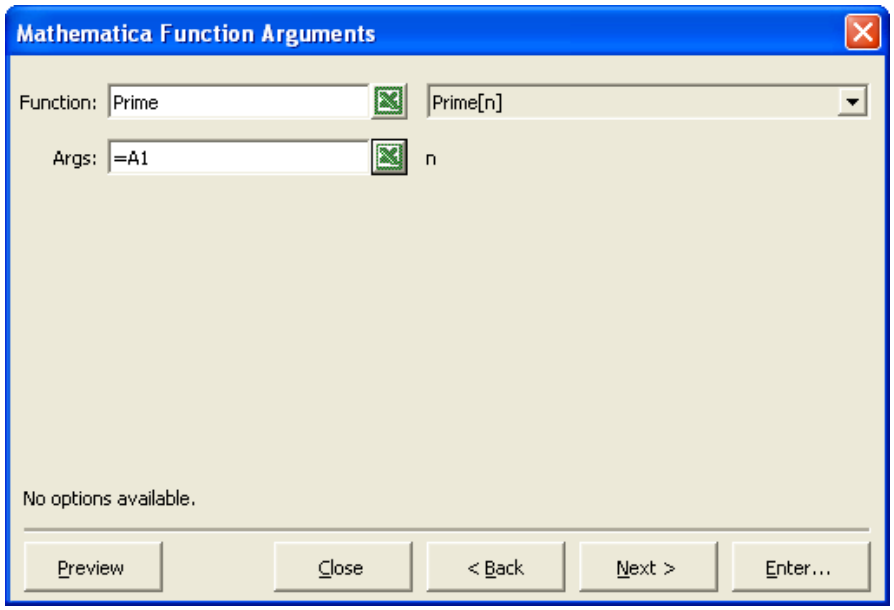
If you are unsure of the name of a *Mathematica* function or how to use it, or want to explore the functions *Mathematica* has to offer, click **Functions** on the *Mathematica* toolbar. This will launch the *Mathematica* Function Wizard.

The first step of the wizard is designed to help you find, and learn about, *Mathematica* functions.



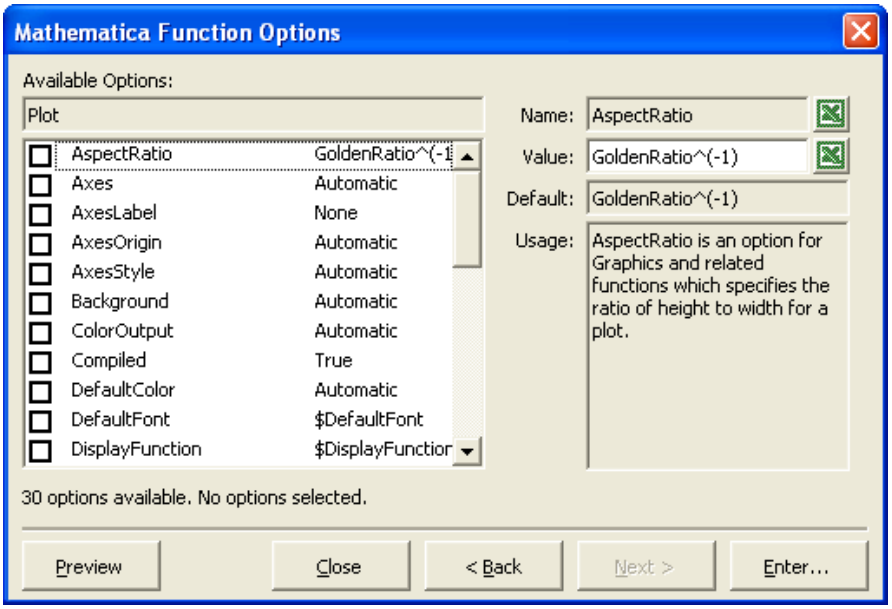
The *Mathematica* Function Wizard—step 1.

The next step is designed to help you interactively specify arguments to the function.



The *Mathematica* Function Wizard—step 2.

An optional third step is available to select and specify options for functions such as `Plot` that have a defined set of options.



The *Mathematica* Function Wizard—step 3.

Notes

- Unlike Excel, *Mathematica* uses case-sensitive syntax. Therefore, be sure to capitalize *Mathematica* function names like `Prime` .
- If you do not include a * character in your name search, the wizard defaults to a *non-case-sensitive* search for **name*.
- You cannot interact with a *Mathematica* front end that is in server mode. If you would like to work in the *Mathematica* front end, you can launch another standard instance of the front end.

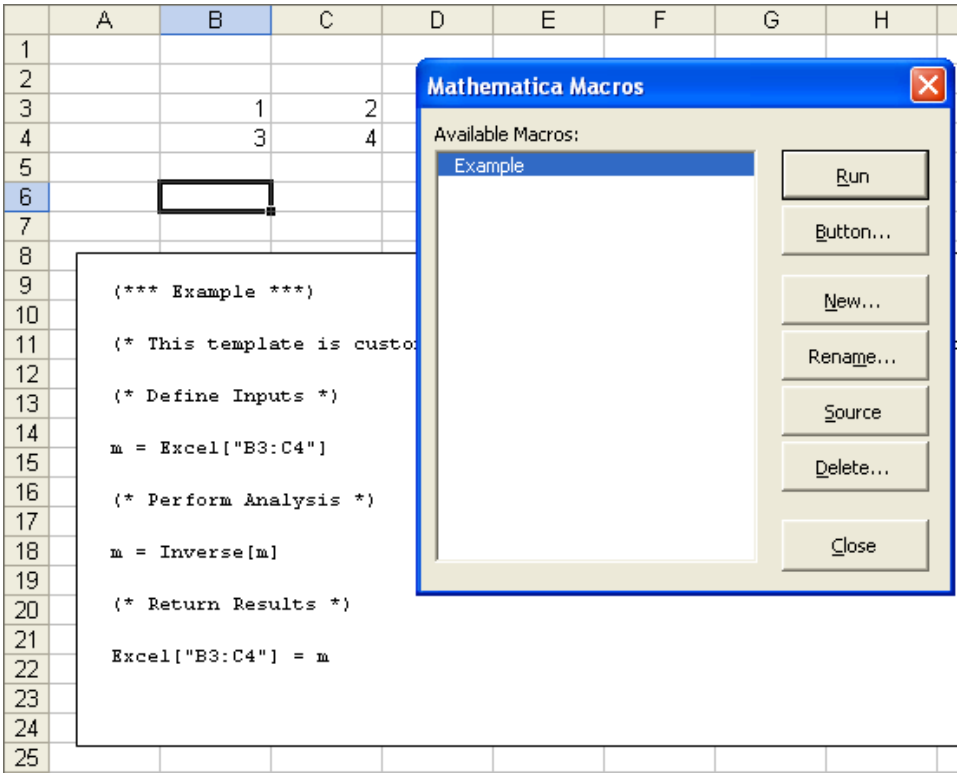
Creating a Macro

To call *Mathematica* code as an Excel macro, the *Mathematica* code must be contained in a named code box inside Excel. Once you have created the named code box, you can then create a button that will call the code in the box. The *Mathematica* Macros manager can help you do this.

To create a macro code box:

- Click **Macros** on the *Mathematica* toolbar.
- Click **New...** and specify a name. In this case, name the macro "Example".
- Select where to place the code box.
- Click **OK**.

The Example macro is added to the list Available Macros and a code box for the Example macro is inserted at the location you specified.



Running *Mathematica* code as an Excel macro.

The initial contents of the code box are specified by a customizable template. In this case, you can leave the default code as is. Before running the code, however, you should type values into the cells referenced in the macro.

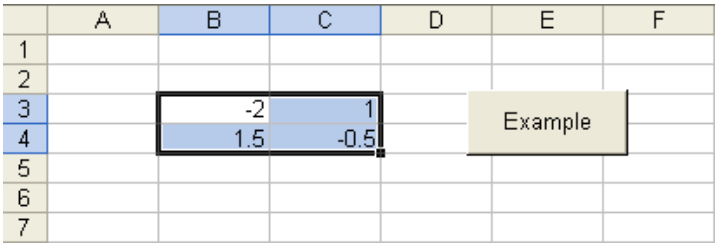
To run a macro:

- Select the macro from the available macros list.
- Click **Run**.

To make it more convenient to run the macro, you can create a button for the macro.

To create a macro button:

- Select the macro from the available macros list.
- Click **Button...** .
- Select where to place the button.
- Click **OK**.



Creating a button for a *Mathematica* macro.

Notes

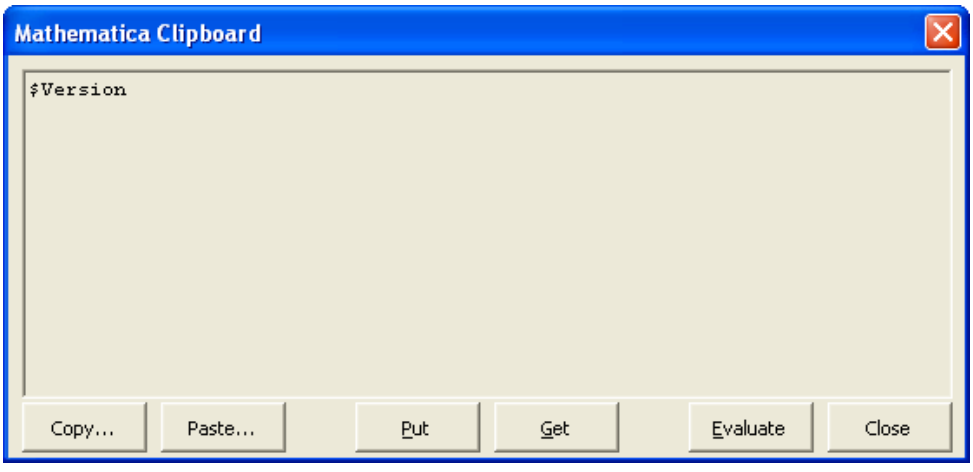
- The default macro name, Initialization, is reserved for code you want to run automatically every time you connect to a kernel or click **Evaluate**.
- To move a button or a code box, hold down the Ctrl key before selecting it.
- Code boxes can be located anywhere in a workbook. They do not need to be on the same sheet as the button calling the code.

Evaluating an Expression

You can use the *Mathematica* Clipboard window to evaluate *Mathematica* expressions the same way you would in a *Mathematica* notebook. This may be useful, for example, to quickly check the state of a variable or experiment with a function you are using for the first time.

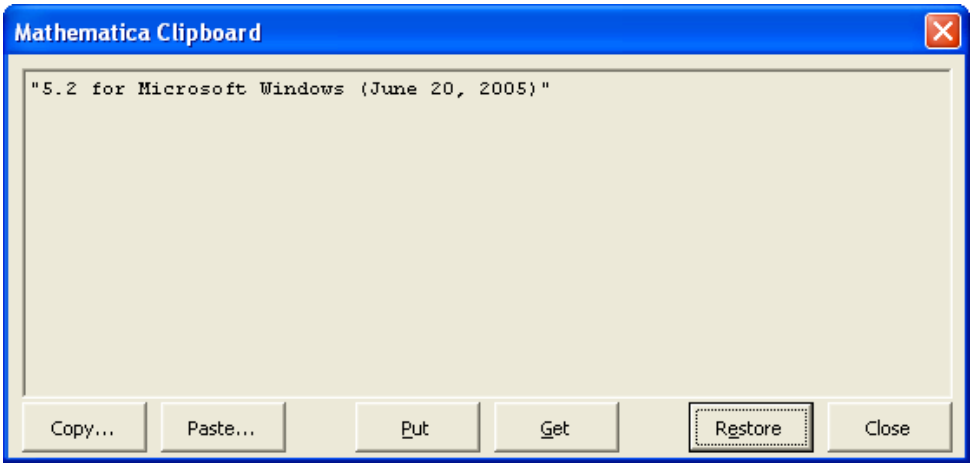
To evaluate an expression in the *Mathematica* Clipboard window:

- Click **Clipboard** on the *Mathematica* toolbar.
- Type the expression into the *Mathematica* Clipboard window.
- Click **Evaluate**.



Typing an expression into the *Mathematica* Clipboard window.

Once the *Mathematica* kernel has evaluated the expression, the answer replaces the contents of the Clipboard window.



Viewing evaluation results in the *Mathematica* Clipboard window.

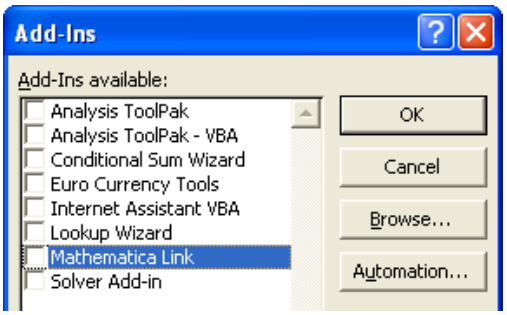
- To restore the original input expression, click **Restore**.

Notes

- To paste evaluation results to a location in Excel, click **Paste**. You will be prompted to specify where to paste the results.
- To paste evaluation results to another program, click **Put**. This puts the evaluation results onto the global Clipboard. You can then paste them into another program.

Unloading the Add-in

If you are finished using the link, you can uncheck *Mathematica Link* in the Add-Ins manager and click **OK**. This unloads the add-in from Excel.



Unloading the *Mathematica Link* add-in.

When you unload the link, you will be prompted to delete your personal settings.

Click **No** to preserve your settings until the next time you use the link. Click **Yes** to restore default settings the next time you use the link.

Notes

- If you do not uncheck *Mathematica Link* in the Add-Ins manager, the link is automatically loaded the next time you start Excel.

Working in Excel: General Principles

Non-Modal Dialogs

All *Mathematica Link* dialogs are non-modal. You can leave dialogs open and still work in Excel.

There are two ways of closing a link dialog:

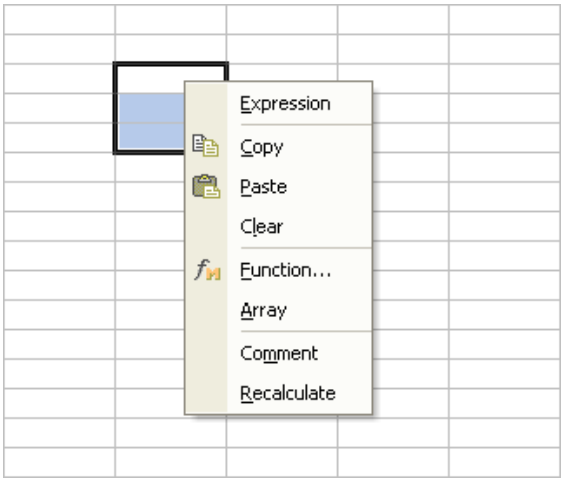
- Click **Close** or press the Esc key. The dialog remembers its current location and state the next time it is displayed.
- Click the **X** in the upper right-hand corner. The dialog returns to a default location and state the next time it is displayed.

Notes

- Occasionally, changes you make in Excel may not be reflected in the contents of an open dialog. If this happens, redisplay the dialog to refresh its contents.

The Context Menu

Mathematica Link commands that operate on the current selection are available from a *Mathematica* context menu. To display this context menu, right-click a range when *Mathematica* contexts are enabled.



The *Mathematica* context menu.

To enable or disable *Mathematica* contexts, click **Contexts** on the *Mathematica* toolbar.

Notes

- All commands on the *Mathematica* context menu also have a keyboard shortcut. See Keyboard Shortcuts for a listing.

Expression Cells

If the Number Format of an Excel cell is set to Text, the contents of the cell are considered to be a *Mathematica* expression when transferring them via the clipboard or in a macro.

For more information, see Strings in the Excel Reference guide.

Notes

- The number format of a range can also be changed using Excel's built-in **Format ▸ Cells ▸ Number** tab.
  Cells should be formatted as Text *before* entering an expression. To convert existing contents to Text, you can reenter them manually or use the provided **Expression** command from the *Mathematica* **Context** menu. Expressions such as $1/2$ or $-x$ can *only* be entered in cells formatted as Text. Otherwise, Excel will attempt to interpret them as something else. When working with expression cells, all cells in the range should be formatted as Text. *Partial* expression ranges are not currently supported. From *Mathematica*, you can use the `ExcelFormat` function to apply or unapply Text format to a range.

Data Cells

If the Number Format of an Excel cell is *anything other than* Text, the cell is considered a data cell.

When transferring the contents of data cells from Excel to *Mathematica*:

- Data is transferred as it is natively stored in Excel. This means, for example, all numbers will be returned as floating point doubles. This includes dates that are numbers with special formatting properties.

When transferring *Mathematica* expression to Excel data cells:

- Non-native expressions are converted to an equivalent Excel data type whenever possible. Expressions that do not have any possible Excel-equivalent are converted to `InputForm` strings.

See the Data Types overview for more details.

Notes

- You can use the `ExcelDate` function and `ExcelForm` functions to work with date values once you get them into *Mathematica*. Cell references in Excel-based formulas such as =EVAL(A1,A2,A3) are an exception to this rule. In this case, you must wrap formula arguments with the provided **DATA** function to treat them as data cells; =EVAL("StringJoin", DATA(A2), DATA(A3)), for example.

Working with Functions

The Link Functions

There are five worksheet functions provided by the *Mathematica Link* add-in.

Function	Use
EVAL	perform *Mathematica* evaluations
EXPR	build *Mathematica* expressions
DATA	specify an argument as native Excel data
RULE	build a *Mathematica* rule
CALC	force a function to respond to the Excel calculate command (F9)

The Link functions.

Together, these functions can be used to build up expressions and perform evaluations in *Mathematica* in very flexible ways. For more detailed information on each worksheet function, see Excel Worksheet Functions.

Using the **EVAL** worksheet function, you can call any function defined in *Mathematica*. This immediately extends the number of functions available inside Excel from a few hundred to several thousand.

Excel syntax	Mathematica syntax
=EVAL("f","arg1","arg2",...)	f[arg1, arg2,...]

The **EVAL** function.

Example	Result
=EVAL("Simplify","x^2+2x+1")	(1 + x)^2
=EVAL("Random","Integer","{1,6}")	an integer between 1 and 6

EVAL examples.

As shown, *Mathematica* syntax must be wrapped in quotes when directly typed into an Excel formula. If this is not done, Excel's formula parser will try to interpret these as Excel syntax. To avoid having to do this, you can create references to arguments in Excel cells. This is discussed in more detail in Specifying Arguments.

In its single-argument form, the **EVAL** function can also be used to evaluate *Mathematica* expressions such as symbols or operator forms of expressions.

Excel syntax	Mathematica syntax
=EVAL("expression")	expression

The single-argument form of EVAL.

Example	Result
=EVAL("$Version")	the version of the kernel you are running
=EVAL("7! + 5!")	5160

EVAL single-argument examples.

Specifying Function Heads

When specifying a *Mathematica* function, the function does not necessarily have to be a named *Mathematica* function. The function can also be specified as a nameless pure function. Using pure functions, you can use multiple functions to create a new function on the fly.

The syntax of *Mathematica* pure functions is as follows:

Slots for individual arguments are specified as `#1`, `#2`, ...

All arguments can collectively be inserted at one point using `##`.

Here, a pure function with two arguments is created in a step-by-step way.

Method	Notes
=EVAL("Sum[1/x^3,{x,10}]")	this sums the first 10 terms in the series
=EVAL("Sum[1/x^3,{x,#1}]","10")	number of terms is now specified as a pure function argument
=EVAL("Sum[1/x^#2,{x,#1}]","10","3")	exponent of x is now specified as a second pure function argument

Creating a pure function.

Note that, as shown, arguments do not have to appear in sequential order inside the function. The index specifies which argument goes where.

Once values that may be edited have been specified as arguments, a reference to the cells containing the values can be made. This is discussed in the next section.

Notes

- If you are familiar with pure functions, you will notice the pure function indicator (`&`) is not used here. There is no need because, in this context, it is clear that if `#` signs are present, a pure function is being specified.
  For more information on creating and using pure functions, refer to the tutorial Pure Functions.

Specifying Arguments

While arguments can be typed directly into a formula, it is generally more convenient to specify arguments as the contents of a cell or a range of cells. Editing values contained in cells is much easier than editing values embedded in a formula. And, if entered in a cell, *Mathematica* syntax does not need to be wrapped in quotes.

Method	Notes
=EVAL("Random[Integer,{1,6}]")	function and its arguments entered as a single expression
=EVAL("Random","Integer","{1,6}")	function arguments passed individually
=EVAL("Random",C2,"{1,6}")	symbol Integer now provided by cell C2
=EVAL("Random",C2,D2:E2)	list {1, 6} now provided by range D2:E2

Specifying range arguments.

Using the last form of the example, you can easily change the upper and lower bound of the random number by changing cells `D2` and `E2`. Also, by typing `Real` in cell `C2` you can change the type of random number returned.

A single column or single row of cells is interpreted as a one-dimensional *Mathematica* list; if a range has multiple rows and multiple columns, it is returned as a 2D list of lists.

Specifying String Arguments

To specify a string in *Mathematica*, you can wrap a text argument with the **DATA** function. The following methods return a list of *Mathematica* functions that end in `Solve`.

Method	Notes
=EVAL("Print",DATA("Hello"))	evaluates `Print [Hello]`
=EVAL("Print",DATA(A1))	string now provided in cell A1

Specifying string arguments.

Specifying Numeric Data

Mathematica evaluations are performed at the precision of the inputs provided. If you would like the kernel to perform evaluations numerically at floating-point precision, wrap your inputs with the **DATA** function.

Method	Notes
=EVAL("Eigenvalues",A1:C3)	performs evaluation using symbolic or numeric methods depending on the inputs provided in A1:C3
=EVAL("Eigenvalues",DATA(A1:C3))	always performs evaluation using numeric methods

Specifying numeric arguments.

Specifying Subexpressions

Using the **EXPR** function you can build up multi-function expressions for a single evaluation.

Method	Notes
=EVAL("f",EXPR("g",1),EXPR("g",2))	evaluates f[g[1],g[2]]

Specifying subexpressions.

Specifying Options

Mathematica functions may have defined options associated with them. To specify an optional argument you can use the **RULE** worksheet function.

Method	Notes
=EVAL("ListPlot",A1:B100,RULE("PlotJoined",D2))	specifies an option using the value in cell D2

Specifying an option.

Generating Graphics

The **EVAL** worksheet functions can also be used to return *Mathematica* graphics.

Example	Result
=EVAL("ListPlot","Table[Random[],{50}]")	`ExcelGraphic[1]`
=EVAL("Graphics","Polygon[{{0,0},{9,3},{3,5}}]")	`ExcelGraphic[2]`
=EVAL("Plot3D","Sin[x+Cos[x y] y]","{x,0,4}","{y,0,4}")	`ExcelGraphic[3]`

EVAL graphics examples.

Mathematica graphics are displayed as picture objects in Excel. By default, these pictures are rendered as Windows metafiles. This format scales reasonably well since it is a vector format. Font sizes, however, may become a bit distorted when a graphic is resized. If this happens, you can force the graphic to be re-rendered at its new size by recalculating its formula. Re-rendering the graphic will reapply any font size you have specified as a graphics option.

Notes

- It is the *name* of a graphic that associates it with a particular Excel cell. For example, if a formula in cell E10 returns graphics, the picture named "Graphic E10" will be updated on the same sheet. If no picture named "Graphic E10" exists on that sheet, a new graphic will be created. This is the extent to which the picture is "linked". When cutting and pasting a *Mathematica*-generated picture to another application or worksheet, this name-based "link" is not maintained. The copied graphic is simply a static picture. By modifying the name of a picture, you can change which cell updates that graphic. To modify the name of a picture, you can select the picture and click in the Name box on the left-hand side of the formula bar.

Generating Messages

If a message is generated during a kernel evaluation, it is sent to the *Mathematica* messages window. Here are some evaluations that generate kernel messages.

Example	Result
=EVAL("7+")	`$Failed` or `#VALUE!`
=EVAL("1/0")	`ComplexInfinity`
=EVAL("Inverse","{{1,2},{2,4}}")	`Inverse[{{1, 2}, {2, 4}}]`

EVAL single argument examples.

When a *Mathematica* evaluation returns `$Failed`, an Excel #VALUE! is returned. This suppresses further evaluations that depend on this result. However, often when messages are generated, the original calculation request may be returned unevaluated, as shown in the last example.

Notes

- Options that control how the link responds to a kernel message can be specified under the ***Mathematica*** **Options ▸ Message** tab.

Using Array Formulas

To return lists of values to multiple cells, *Mathematica* functions can be entered as an array formula. Some functions in *Mathematica* naturally return lists, others can be mapped over lists. Here are some examples.

Example	Result
=EVAL("Range","10")	{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
=EVAL("Map","Factorial",A1:A10)	a list containing the factorial of each number in A1:A10

Formulas that can be entered as an array.

To enter a formula as an array:

Select all cells that will be in the array.

Enter the formula.

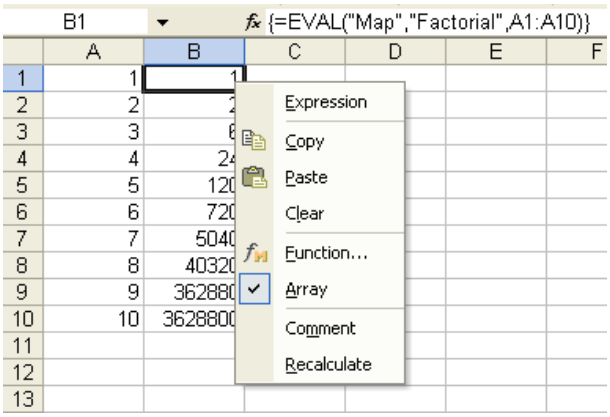
Press Ctrl + Shift + Enter.

Once entered, array formulas appear surrounded by { } in the formula bar. All cells in an array formula range share a single formula, each element of the array returned to a separate cell.

The *Mathematica Link* add-in provides two tools to help make using array formulas easier:

The *Mathematica* Function Wizard can help you automatically enter and edit array formulas.

The **Array** command on the *Mathematica* context menu provides a way to easily toggle between single-cell and array formulas.



The **Array** toggle command on the *Mathematica* context menu.

Notes

- If you manually edit an array formula but forget to select all cells in the array beforehand, an error message will appear when you try to reenter the formula. If this happens, press Esc to cancel any changes you made. Then, select all cells in the array before making the changes again.
- Array formulas can significantly reduce calculation times if the same operation is being performed on a large number of cells. If you have filled a range with the same formula by dragging the formula across the range, it may be much faster to perform these calculations using an array formula. There is a transaction time associated with each call to *Mathematica.* If a single array formula is used to return values for 100 cells, recalculation could be up to 100 times faster than calling 100 individual formulas.

Controlling Recalculation

Forcing Recalculation

Excel typically recalculates formulas only when the inputs to a formula have been changed. However, when you change the definition of a function or the value of a symbol in *Mathematica,* there is no way for Excel to automatically know about this change. In this case, you may want to force formulas to recalculate.

To force repeated recalculation of a specific formula:

Wrap the formula with the **CALC** function. You can then trigger recalculation of that formula by pressing F9.

Example	Description
=CALC(EVAL("Random[]"))	gives a new random number each time F9 is pressed

Marking a formula for repeated calcuation using the **CALC** function.

To force one-time recalculation of the current selection:

Press Ctrl + Shift + = or choose **Recalculate** from the *Mathematica* context menu.

To force recalculation of all link functions in the current workbook:

Click the **Evaluate** button. This is an option specified under ***Mathematica*** **Options ▸ Workbook**.

Disabling Recalculation

By temporarily storing formulas as comments, you can disable recalculation on a formula-by-formula basis. You may want to do this to preserve currently calculated values or to suppress unwanted recalculation.

To comment link formulas in the current selection:

Press Ctrl + Shift + ' or check **Comment** from the *Mathematica* context menu.

To uncomment link formulas in the current selection:

Press Ctrl + Shift + ' again or uncheck **Comment** on the *Mathematica* context menu.

Commenting a formula essentially freezes the formula in its currently calculated state. Commenting formulas for an entire workbook is discussed as a way of sharing a workbook with others in Sharing Workbooks.

Notes

- To select an entire sheet, click the upper left-hand corner of the header row, between `A` and `1`. You can then apply selection commands to the sheet.
- The **CALC** function can be used to generate random numbers for Excel-based simulations.

Working with Macros

Macro Types

There are three types of *Mathematica* macros that you can create.

Macro Type	Description
Definitions Macro	defines *Mathematica* functions used in a workbook
Processing Macro	processes a workbook when the **Evaluate** button is clicked
Task Macro	performs a task when an associated button on a spreadsheet is clicked

Types of *Mathematica* macros.

The difference between the first two is that a workbook definitions macro does not perform actions on a workbook, a workbook processing macro does.

All *Mathematica* macros can be deployed by creating a code box to store the *Mathematica* code inside a workbook. For workbook-level macros, however, you can also store the *Mathematica* code in a package file.

Macro Type	Deployment
Definitions Macro	initialization code box or workbook package file
Processing Macro	initialization code box or workbook package file
Task Macro	macro code box

Deploying *Mathematica* macros.

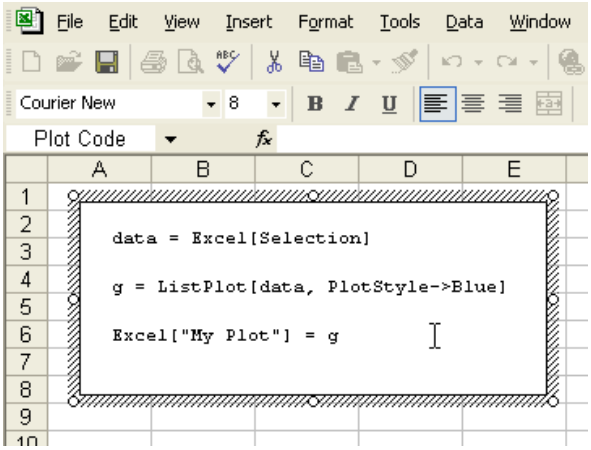
A workbook package file should be in the same directory and have the same name as a workbook with the .m extension replacing .xls.

Working with Code Boxes

Code boxes are simply text boxes that have been formatted for writing *Mathematica* code and given a special name. They are, in every other way, ordinary text boxes.

There are two ways of selecting a text box: selecting the box itself or selecting text inside the box. The selection border of the text box will be different in each case. To do anything other than edit the text inside the box you will need to make sure the box itself is selected. Once the box itself is selected, you can, for example, move it or resize it, copy and paste it to another location, or delete it.

When typing in a text box, be aware that Excel goes into a different mode. Most toolbar buttons, for example, are no longer available.



Excel while in edit mode.

As with many toolbar buttons, *Mathematica* macros do not work while Excel is in this mode. To get out of this edit mode, press the Esc key or click out of the box.

Working with Buttons

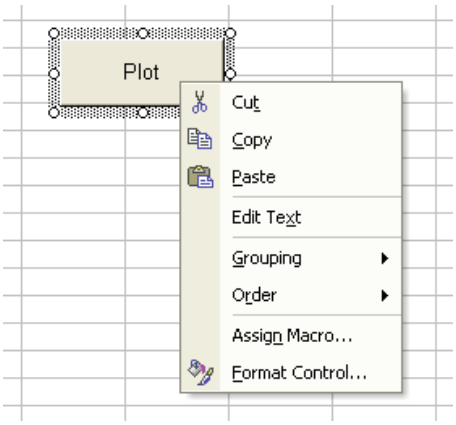
By default, the caption of the button will be the same as the macro name. You can change this. You can also change the size of the button or move it. To do this, you will need to select the button.

To select a button:

- Hold down the Ctrl key and then click the button.

Once you have a button selected, you can work with it as you would any other shape. You can, for example, move it or resize it, change its caption, copy and paste it to another location, or delete it.

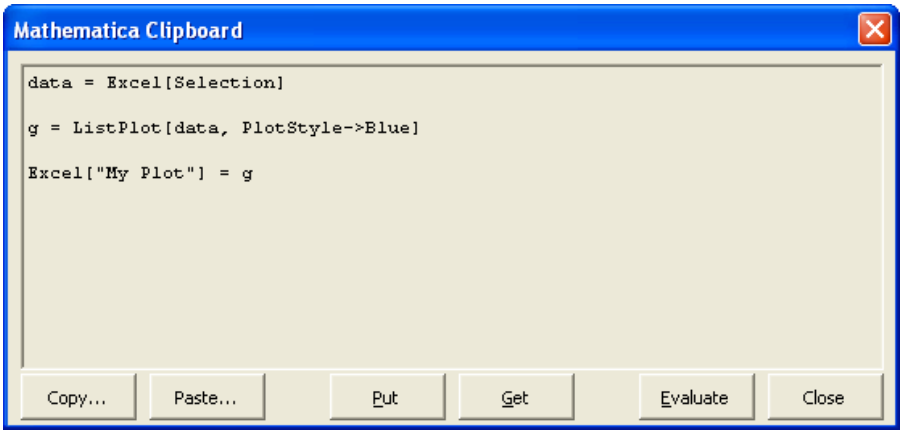
Right-clicking a button will also select it and work with it in various ways.



Right-clicking a macro button.

Developing on the Clipboard

The *Mathematica* Clipboard window can evaluate multiple lines of code at a time. When multiple lines are evaluated on the Clipboard, only the result from the last line is returned. You can use this behavior to progressively build up code that can be used as a macro by alternatively clicking **Evaluate** and **Restore**.



Developing code on the Clipboard.

When used this way, the *Mathematica* Clipboard window becomes a floating macro code box. The Clipboard **Evaluate** button becomes a **Run** button for the macro during development. When you are done developing, you can transfer the code to a code box.

To transfer code from the *Mathematica* Clipboard to a code box:

- Click **Put** on the *Mathematica* Clipboard.
- Select where to put the code in the code box.
- Press Ctrl + V or choose **Edit ▸ Paste**.

Developing in *Mathematica*

If you are familiar with the *Mathematica* notebook front end, you can develop code in that environment, then transfer it to a code box in Excel.

For more information on developing macros in *Mathematica*, see Creating Excel Macros.

Protecting Your Code

Once you have developed a macro, you may want to protect your code. This can be done by hiding or protecting the sheet containing the code.

To hide a sheet in Excel:

- Click **Format ▸ Sheet ▸ Hide**.

To protect a sheet in Excel:

- Click **Tools ▸ Protection ▸ Protect Sheet**.

See Excel's Help menu for more information on these commands.

Link Management

Opening a Link

The first time you request a *Mathematica* evaluation in Excel, a link to a *Mathematica* kernel will open automatically. If you would like to force a link to open, even if there is nothing to evaluate, you can:

- Click the **Evaluate** icon on the *Mathematica* toolbar.

You can manually specify a kernel to connect to using the *Mathematica* **Options ▸ Kernel** tab. Settings you specify will be used automatically the next time you connect.

Notes

- If you do not have a typical *Mathematica* installation, you may be required to specify a kernel the first time you use the link.

Interrupting Evaluations

To interrupt a *Mathematica* evaluation:

- Click **Evaluate** on the *Mathematica* toolbar.

Although most *Mathematica* evaluations can be interrupted, some cannot. If the kernel does not respond to an abort request after some time, you can choose to close the kernel to end the evaluation.

To close a kernel during an evaluation and return control to Excel:

- Hold down Shift and click **Evaluate** on the *Mathematica* toolbar, or
- Right-click the *Mathematica* kernel in the task bar and choose **Close**.

Notes

- Pressing the Esc key does not interrupt *Mathematica* evaluations. The Esc key is used by Excel to send interrupts to local Visual Basic code.
- Aborted formulas return #NULL!, thereby suppressing evaluation of dependent formulas.

Closing a Link

To close a link with a *Mathematica* kernel, you can:

- Hold down the Shift key while clicking **Evaluate**.
- Click **Close** under *Mathematica* **Options ▸ Kernel**.
- Evaluate `Quit[]` in the Clipboard window, a function, or a macro.

Notes

- The kernel is automatically closed whenever Excel is closed or the *MathematicaLink* add-in is uninstalled.

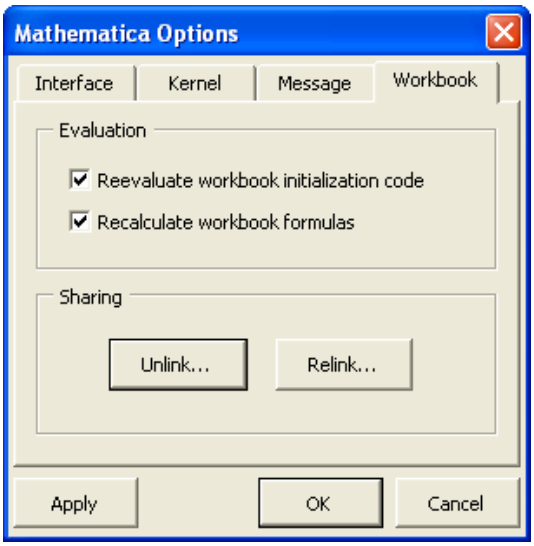
Sharing Workbooks

Unlinking a Workbook

Before sharing a workbook containing *Mathematica* formulas or macros, you may first want to unlink the workbook. Unlinking a workbook will allow others to take a look at the results in the workbook without launching a kernel, encountering pathnames from your hard drive, or inadvertantly replacing cell values with #NAME? errors.

To unlink a workbook:

- Click **Unlink** on the *Mathematica* **Options ▸ Workbook** tab.



Unlinking a workbook.

When unlinked, formulas are stored as cell comments, and macro buttons display a "macro cannot be found" error when clicked.

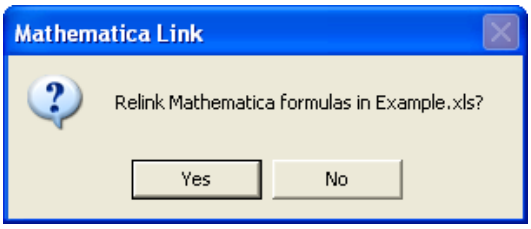
Once a workbook is unlinked, it can easily be viewed without problems on other machines, even machines where *Mathematica Link* is not installed. Those who do have the link will have the option of relinking the workbook and interacting with it.

Notes

- In Excel, cell comments are typically indicated by a small red triangle in the upper-right corner of a cell. This is an option that can be specified under **Tools ▸ Options ▸ View**. To view a comment, place your cursor over the cell.

Relinking a Workbook

When opening an unlinked workbook, link users are automatically prompted to relink formulas in the workbook.



- Click **Yes** to relink all formulas contained in the workbook.
- Click **No** to leave the workbook as is. You can relink formulas later, at any time, by clicking **Relink** on the *Mathematica* **Options ▸ Workbook** tab.

Notes

- Relinking formulas recalculates all *Mathematica* formulas in the workbook, overwriting the existing set of results.
  If a workbook contains only *Mathematica* macros, the relink prompt will not appear. Macro buttons are relinked without prompting since this has no other impact on the workbook.

Fixing Broken Links

If a workbook was not unlinked prior to opening it on another machine, broken path-based formula links can be fixed automatically by clicking **Relink** under *Mathematica* **Options ▸ Workbook**.

This is possible, of course, only if the *Mathematica Link* add-in is available on that machine.

Notes

- Fixing broken links recalculates all *Mathematica* formulas in the workbook, overwriting the existing set of results.

Loading the Add-In

Before you can transfer data between *Mathematica* notebooks and Excel workbooks via the clipboard, you first need to load the *Mathematica Link* add-in in Excel. To do this, see Working in Excel: Getting Started.

Once installed, the *Mathematica Link* add-in adds special copy and paste commands to Excel. These commands convert Excel data to and from *Mathematica* lists.

Copying Data from Excel

To copy the contents of an Excel range to a *Mathematica* notebook:

- In Excel, select the range you want to copy.
- Press Ctrl + Shift + C or right-click and choose **Copy** if *Mathematica* Contexts are enabled. This will copy the contents of the range onto the Clipboard as a *Mathematica* list.
- Switch to your *Mathematica* notebook and place the cursor where you would like to insert the list.
- Press Ctrl + V or choose **Paste** from the **Edit** menu.

Notes

- If the contents of the range were not converted into a *Mathematica* list, verify *Mathematica* keyboard shortcuts are enabled in Excel. You can do this under *Mathematica* **Options ▸ Interface**.
- By default, text cells are copied as *Mathematica* strings. Only cells formatted as Text are considered to contain *Mathematica* expressions. See Strings. If needed, you can convert strings to expressions using `ToExpression[`*data*`]`.
- Empty cells are copied as the symbol `Empty`. If needed, you can convert these to a desired default value, such as `0` or `""`, using `ReplaceAll[`*data*`, Empty -> `*val*`]`.

Pasting Data to Excel

To paste the contents of a *Mathematica* list to an Excel range:

- In a *Mathematica* notebook, select the list you wish to copy.
- Press Ctrl + C or choose **Copy** from the **Edit** menu.
- Switch to Microsoft Excel and select where to insert the contents of the list. If a single cell is selected, data will be pasted below and to the right of that cell.
- Press Ctrl + Shift + V or right-click and choose **Paste** if *Mathematica* contexts are enabled.

Notes

- If nothing was pasted, verify *Mathematica* keyboard shortcuts are enabled in Excel. You can do this under *Mathematica* **Options ▸ Interface**.
- For best results, convert your data to *Mathematica* `InputForm` before pasting the data into Excel. You can do this in *Mathematica* or using the *Mathematica* Clipboard window in Excel. See Fixing Problematic Data.
  Be sure the opening and closing brackets of the *Mathematica* list are selected. Excel will not recognize the Clipboard contents as a *Mathematica* list unless these brackets are present.
- A convenient way to select an entire *Mathematica* list is to place the cursor at the beginning of the list and triple-click.

Fixing Problematic Data

If you run into problems pasting data into Excel, it is likely the copied data is not in the proper form. The **Paste** command requires data to be in *Mathematica* `InputForm`. Depending on how you copied the data and from what kind of notebook cell you copied it, you may end up with data in a format other than `InputForm`.

The **Paste** command can fix certain common problems with the data automatically; however, in some cases you may still need to convert to `InputForm` on your own.

You can do this in two ways:

- In *Mathematica* before copying, use **Cell ▸ Convert ▸ InputForm**.
- In Excel, after copying, use the **Evaluate** button in the *Mathematica* Clipboard window.

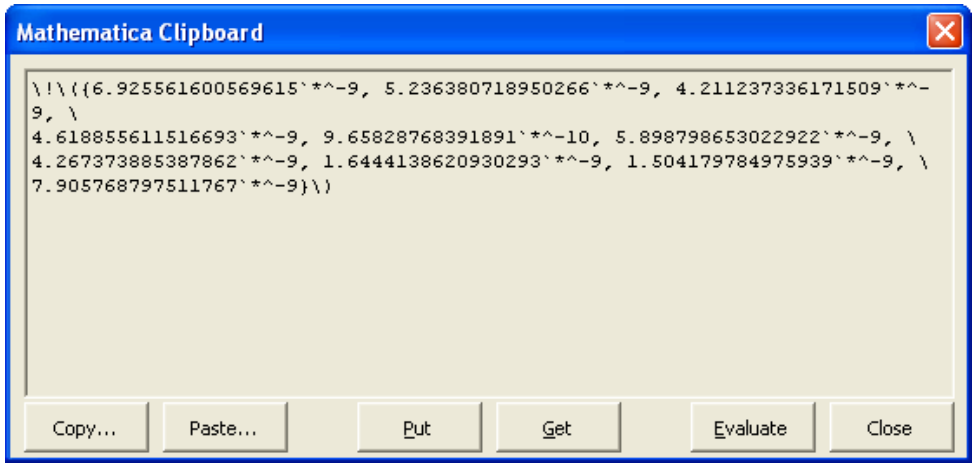
If you do not want to modify your source notebook, the second approach is the most convenient.

Here is an example of some data to paste.

```
In[1]:= data = Table[Random[] * 10^-8, {10}]
```

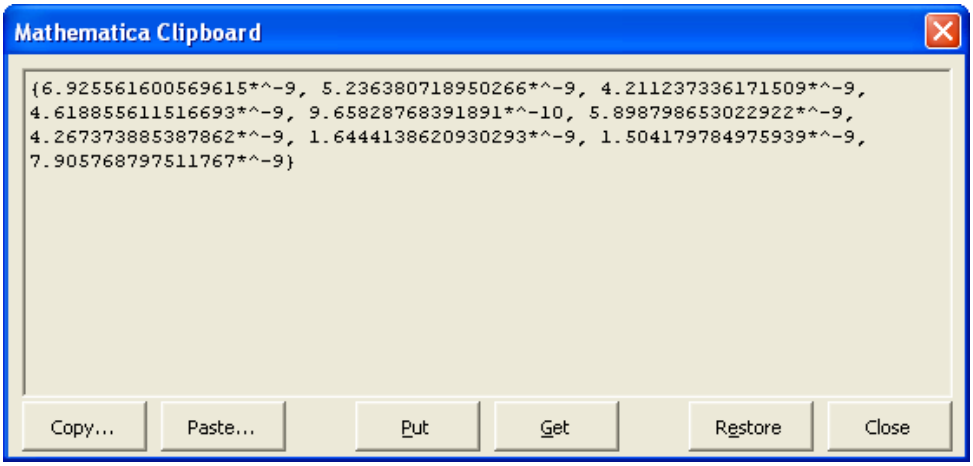
$$\text{Out[1]}= \{6.92556\times10^{-9},\ 5.23638\times10^{-9},\ 4.21124\times10^{-9},\ 4.61886\times10^{-9},\ 9.65829\times10^{-10},\ 5.8988\times10^{-9},\ 4.26737\times10^{-9},\ 1.64441\times10^{-9},\ 1.50418\times10^{-9},\ 7.90577\times10^{-9}\}$$

To view this data in the *Mathematica* Clipboard window, copy the output, then in Excel, open the *Mathematica* Clipboard window and click **Get**.



The *Mathematica* Clipboard window before clicking **Evaluate**.

You can see that additional formatting characters are present in the data. In this case, the fixes are minor, so pasting directly into Excel does, in fact, still work. However, you can also convert the contents of the Clipboard to `InputForm` by clicking **Evaluate**.



The *Mathematica* Clipboard window after clicking **Evaluate**.

Once the data has been standardized to `InputForm`, you can continue to paste it into Excel using the standard Paste command or the **Paste** button on the Clipboard window.

Notes

- An alternative to copying and pasting is to assign and retrieve Excel data programmatically from *Mathematica*. This can be significantly faster if you are dealing with large datasets. For more information, see Getting Started.

Excel Worksheet Functions

EVAL

=EVAL(*expr*) evaluates *expr* in a *Mathematica* kernel.
=EVAL(*head*, *arg*1, *arg*2, ...) builds an expression from the provided *head* and *args* and evaluates it.

- =EVAL(*head*, *arg*1, *arg*2, ...) is equivalent to =EVAL(EXPR(*head*, *arg*1, *arg*2, ...)).
- You can use =EXPR(*head*, *arg*1, *arg*2, ...) to see exactly what will be evaluated in *Mathematica*.
- =EVAL(*head*, *arg*1, *arg*2, ...) evaluates only once *head* and all arguments have been provided. If *head* or any argument refers to an empty cell or an error, evaluation is suppressed and #N/A is returned.
- See notes for EXPR.
- See also: DATA, RULE.

EXPR

=EVAL(*expr*) evaluates *expr* in a *Mathematica* kernel.
=EVAL(*head*, *arg*1, *arg*2, ...) builds an expression from the provided *head* and *args* and evaluates it.

- =EXPR(*head*, *arg*1, *arg*2, ...) builds the *Mathematica* expression *head*[*arg*1, *arg*2, ...].
- Example: =EXPR("f","x","y") returns f[x,y].
- You can build any expression using nested **EXPR** calls.
- Example: =EXPR("Sqrt",EXPR("Plus",EXPR("Power",A1,2),EXPR("Power",A2,2))).
- If *head* contains #, *head* is automatically assumed to be a pure function.
- Example: =EXPR("Sqrt[#1^2+#2^2]",A1,A2).
- =EXPR(*head*, *arg*1, *arg*2, ...) returns #N/A if *head* or any arguments refer to an empty cell or an error.
- =EXPR(*range*) trims empty cells and errors from the end of *range*.
- See also: EVAL, DATA, RULE.

DATA

=EVAL(*expr*) evaluates *expr* in a *Mathematica* kernel.

=EVAL(*head*, *arg*1, *arg*2, ...) builds an expression from the provided *head* and *args* and evaluates it.

- The **DATA** function is typically used inside **EVAL**, **EXPR**, or **RULE** calls.
- Example: `=EVAL("FileNames",DATA("*"),DATA("C:\"))`.
- You can wrap numeric data in the **DATA** function to ensure numeric calculation methods are used instead of symbolic methods. The former is often much faster.
- Example: `=EVAL("Eigenvalues",DATA(A1:B2))`.
- Unlike **EXPR** ranges, **DATA** ranges can contain empty cells or errors.
- `=DATA(`*range*`)` trims empty cells and errors from the end of *range*.
- See also: EVAL, EXPR, RULE.

RULE

=EVAL(*expr*) evaluates *expr* in a *Mathematica* kernel.

=EVAL(*head*, *arg*1, *arg*2, ...) builds an expression from the provided *head* and *args* and evaluates it.

- `=RULE(`*lhs*, *rhs*`)` builds the *Mathematica* expression *lhs*`->`*rhs*.
- Example: `=RULE("x",1)` returns `x->1`.
- The **RULE** function can be used to specify options for the *Mathematica* function in **EVAL** or **EXPR** calls.
- Example: `=EVAL("Plot",A1,A2:A4,RULE("PlotTitle",A1),RULE("PlotStyle","Blue"))`.
- If *lhs* and *rhs* are references to multicell ranges of the same size, a list of rules is returned.
- Example: `=EVAL("ReplaceAll",A1,RULE(A2:A4,B2:B4))`.
- See also: EVAL, EXPR, DATA.

CALC

=EVAL(*expr*) evaluates *expr* in a *Mathematica* kernel.
=EVAL(*head*, *arg*1, *arg*2, ...) builds an expression from the provided *head* and *args* and evaluates it.

- Volatile functions recalculate when *any cell* changes or when the F9 key is pressed.
- Nonvolatile formulas recalculate only when a referenced input cell changes.
- Excel functions `RAND()` and `NOW()` are examples of built-in volatile functions.
- Volatile functions are typically used to run simulations in Excel.
- You can use the **CALC** worksheet function to use *Mathematica*-generated random numbers within Excel-based simulations.
- Example: `=CALC(EVAL("Random[Integer,{1,6}]"))`.
- You can use the **CALC** worksheet function to "tag" specific functions to respond when F9 is pressed or when `ExcelCalculate` is called from *Mathematica* code.
- Example: `=CALC(EVAL("Set", "stockprice", G10))`.
- Note: volatile functions recalculate frequently and can, therefore, significantly slow down recalculation and editing operations in your spreadsheet. To avoid any potential problems, use volatile functions sparingly and, if needed, disable them when making modifications to your spreadsheets.
- See also: EVAL.

Toolbar Commands

Evaluate

Establishes a connection with a *Mathematica* kernel.

Reinitializes and/or recalculates the active workbook (based on workbook options).

Closes or resets the connection with a *Mathematica* kernel (depending on modifier key).

Interrupts *Mathematica* evaluation (if an evaluation is currently running).

- Workbook options can be specified under the *Mathematica* **Options ▸ Workbook** tab.
  Shift +click: closes the kernel.
  Ctrl +click: clears the kernel's Global context. (Soft kernel reset)
  Ctrl + Shift +click: closes and restarts the kernel. (Hard kernel reset)
- Location: *Mathematica* toolbar, *Mathematica* menu
- Keyboard shortcut: Ctrl + Alt + E

Functions

Establishes a connection with a *Mathematica* kernel.

Reinitializes and/or recalculates the active workbook (based on workbook options).

Closes or resets the connection with a *Mathematica* kernel (depending on modifier key).

Interrupts *Mathematica* evaluation (if an evaluation is currently running).

- If no link formula is selected, the Wizard starts at the *Mathematica* Function Browser step.
- If an existing link formula is selected, the Wizard starts at the *Mathematica* Function Arguments step, and the Wizard is populated with the existing formula.
- Using the Wizard you can search for, learn about, and interactively build and edit *Mathematica* function calls.
- Note: the Wizard is nonmodal. You can leave it open and still work in Excel.
- Location: *Mathematica* toolbar, *Mathematica* menu
- Keyboard shortcut: Ctrl + Alt + F

Macros

Establishes a connection with a *Mathematica* kernel.

Reinitializes and/or recalculates the active workbook (based on workbook options).

Closes or resets the connection with a *Mathematica* kernel (depending on modifier key).

Interrupts *Mathematica* evaluation (if an evaluation is currently running).

- Using this window, you can create code boxes and corresponding buttons that allow you to run *Mathematica* code as if it were an Excel macro. Using this window, you can also create initialization code boxes for workbooks that contain code that is run automatically when you connect to a kernel or reevaluate the workbook.
- Note: the window is nonmodal. You can leave it open and still work in Excel.
- Location: *Mathematica* toolbar, *Mathematica* menu
- Keyboard shortcut: Ctrl + Alt + M

Clipboard

Establishes a connection with a *Mathematica* kernel.

Reinitializes and/or recalculates the active workbook (based on workbook options).

Closes or resets the connection with a *Mathematica* kernel (depending on modifier key).

Interrupts *Mathematica* evaluation (if an evaluation is currently running).

- Using this window, you can interactively copy and paste data to Excel ranges.
- You can also type code directly into the *Mathematica* Clipboard window, evaluate it, and view the results.
- Note: the window is nonmodal. You can leave it open and still work in Excel.
- Location: *Mathematica* toolbar, *Mathematica* menu
- Keyboard shortcut: Ctrl + Alt + C

Contexts

Establishes a connection with a *Mathematica* kernel.

Reinitializes and/or recalculates the active workbook (based on workbook options).

Closes or resets the connection with a *Mathematica* kernel (depending on modifier key).

Interrupts *Mathematica* evaluation (if an evaluation is currently running).

- When menus are enabled, if you right-click a range, a custom *Mathematica* Context menu will appear.

- When menus are disabled, if you right-click a range, the default Excel Context menu will appear.
- Location: *Mathematica* toolbar, *Mathematica* menu
- Keyboard shortcut: Ctrl + Alt + X

Messages

Establishes a connection with a *Mathematica* kernel.

Reinitializes and/or recalculates the active workbook (based on workbook options).

Closes or resets the connection with a *Mathematica* kernel (depending on modifier key).

Interrupts *Mathematica* evaluation (if an evaluation is currently running).

- Using this window, you can use view messages generated by the *Mathematica* kernel.
- You can also locate the source of messages, browse through past messages, and save messages to a log file.
- Note: the window is nonmodal. You can leave it open and still work in Excel.
- Location: *Mathematica* toolbar, *Mathematica* menu
- Keyboard shortcut: Ctrl + Alt + G

Options

Establishes a connection with a *Mathematica* kernel.

Reinitializes and/or recalculates the active workbook (based on workbook options).

Closes or resets the connection with a *Mathematica* kernel (depending on modifier key).

Interrupts *Mathematica* evaluation (if an evaluation is currently running).

- You can browse this window to explore link options available to you. If you change an option, but want to leave the window open, click **Apply** to apply the changes.
- Note: the window is nonmodal. You can leave it open and still work in Excel.
- Location: *Mathematica* toolbar, *Mathematica* menu
- Keyboard shortcut: Ctrl + Alt + O

Help

Establishes a connection with a *Mathematica* kernel.

Reinitializes and/or recalculates the active workbook (based on workbook options).

Closes or resets the connection with a *Mathematica* kernel (depending on modifier key).

Interrupts *Mathematica* evaluation (if an evaluation is currently running).

- Adobe Reader is required to view this version of the manual.
- Contents of this manual can also be viewed in the *Mathematica* Documentation Center under **Add-Ons & Links ▸ *Mathematica Link for Excel***.
- Location: *Mathematica* toolbar, *Mathematica* menu
- Keyboard shortcut: Ctrl + Alt + H

Context Commands

Expression

Toggle command. Applies or removes the Text number format from the selected range.

- Contents of the range are automatically reentered after the format change.
- If the number format for all cells is Text, the format for all cells is changed to General.
- If the number format for all cells is not Text, the format for all cells is changed to Text.
- Location: Context Menu
- Keyboard shortcut: Ctrl + Shift + E

Copy

Toggle command. Applies or removes the Text number format from the selected range.

- If the number format for all cells is Text, strings are copied as *Mathematica* text expressions.
- If the number format for all cells is not Text, strings are copied as *Mathematica* strings.
- The copy command uses *Mathematica* `InputForm` to represent the contents of the range.
- If the *Mathematica* Clipboard window is open, the window is automatically updated, allowing you to view what has been placed on the Clipboard.
- Location: Context Menu
- Keyboard shortcut: Ctrl + Shift + C

Paste

Toggle command. Applies or removes the Text number format from the selected range.

- If the number format for all cells in the target range is Text, the contents of the Clipboard will be pasted as *Mathematica* text expressions.
- If the number format for all cells is not Text, the contents of the Clipboard will be converted to native Excel data types wherever possible.
- If the *Mathematica* Clipboard window is open, you can view the text expression before it is pasted.
  The **Paste** command requires the contents of the Clipboard to be in *Mathematica* `InputForm`.
  Note: If the expression on the Clipboard is not in `InputForm`, you can use the *Mathematica* Clipboard window to convert the expression to `InputForm` by clicking **Evaluate**.

- Location: Context Menu
- Keyboard shortcut: Ctrl + Shift + V

Clear

Toggle command. Applies or removes the Text number format from the selected range.

- When using this command, the number format for the range is reset to General. This is the only difference between this command and the Excel standard **Edit ▸ Clear Contents** command.
- Location: Context Menu
- Keyboard shortcut: Ctrl + Shift + Delete

Function

Toggle command. Applies or removes the Text number format from the selected range.

- If the selected cell does not contain a link formula, the Wizard goes directly to the *Mathematica* Function Arguments step. This is the only difference between this command and the **Toolbar Command ▸ Functions** command.
- Use this command if you know what function you would like to enter, and you do not need to browse for it.
- See also: **Toolbar Command ▸ Functions**
- Location: Context Menu
- Keyboard shortcut: Ctrl + Shift + F

Array

Toggle command. Applies or removes the Text number format from the selected range.

- When converting an array formula to a single-cell formula, you can select the top-left cell or the entire array.
- When converting a single-cell formula to an array formula, the array formula is automatically sized correctly, or you can preselect the cells you would like to be included in the array.
- Location: Context Menu
- Keyboard shortcut: Ctrl + Shift + A

Comments

Toggle command. Applies or removes the Text number format from the selected range.

- Commenting formulas allows you to temporarily disable evaluation of the selected formulas.
- To comment all *Mathematica* formulas on a sheet, click the top-left corner of the header rows between A and 1 to select the entire sheet.
- To comment all *Mathematica* formulas in a workbook, click **Unlink** under ***Mathematica* Options ▸ Workbook**.
- Location: Context Menu
- Keyboard shortcut: Ctrl + Shift + '

Recalculate

Toggle command. Applies or removes the Text number format from the selected range.

- To force recalulation of all *Mathematica* formulas on a sheet, click the top-left corner of the header rows, between A and 1 to select the entire sheet.
- To force recalculation of all *Mathematica* formulas in the workbook, you can click **Evaluate** if your options are set to do so.
- Location: Context Menu
- Keyboard shortcut: Ctrl + Shift + =

Keyboard Shortcuts

Toolbar Shortcuts

Keyboard shortcuts are available for all commands on the *Mathematica* toolbar. These toolbar shortcuts all include the Alt key.

Evaluate	Ctrl + Alt + E
Functions	Ctrl + Alt + F
Macros	Ctrl + Alt + M
Clipboard	Ctrl + Alt + C
Contexts	Ctrl + Alt + X
Messages	Ctrl + Alt + G
Options	Ctrl + Alt + O
Help	Ctrl + Alt + H

Keyboard shortcuts for *Mathematica* toolbar commands.

For descriptions of these commands, see the Toolbar Commands section in this reference guide.

Context Shortcuts

Keyboard shortcuts are available for all commands in the *Mathematica* context menu. Context shortcuts all include the Shift key. They all operate on the *current selection* in Excel.

Expression	Ctrl + Shift + E
Copy	Ctrl + Shift + C
Paste	Ctrl + Shift + V
Clear	Ctrl + Shift + Delete
Function	Ctrl + Shift + F
Array	Ctrl + Shift + A
Comments	Ctrl + Shift + '
Recalculate	Ctrl + Shift + =

Keyboard shortcuts for *Mathematica* context menu commands.

For descriptions of these commands, see the Context Commands section in this reference guide.

Workbook Shortcuts

Keyboard shortcuts are available for the following *workbook-level* operations.

Reevaluate initialization code	Ctrl + Enter
Recalculate link formulas	Ctrl + =
Unlink / Relink workbook	Ctrl + '

Keyboard shortcuts for workbook operations.

The functionality provided by some of these commands can optionally occur automatically as part of the **Evaluate** toolbar command. Related options and buttons can be found on the *Mathematica* **Options ▸ Workbook** tab.

Notes

- Keyboard shortcuts can be disabled and re-enabled using the *Mathematica* **Options ▸ Interface** tab.

Data Types

Overview

Excel cells can contain six different types of data.

Numbers	machine–precision double
Dates	machine–precision double with special formatting
Strings	unicode text
Booleans	TRUE , FALSE
Errors	#VALUE! , #REF! , ...
Empty	empty cell

Native Excel data types.

Mathematica data types not natively supported by Excel can be stored as strings in a range formatted as Text.

Integer	1
Rational	1/2
Complex	1 + 2 I
Symbol	x
Expression	$x + y$

Mathematica data types that can be stored in text cells.

To specify the format of a range, you can use the `ExcelFormat` function provided by the *ExcelLink* package. Or, from within Excel, you can select a format in the **Format ▸ Cell... ▸ Number** pane or use the **Expression** toggle command provided by the *MathematicaLink* add-in.

Notes

- For worksheet functions, such as **EVAL** or **EXPR**, inputs are *always* assumed to contain text expressions, even if Text formatting has not been applied to input ranges. This assumption makes it easier to build *Mathematica* expressions. To use data as it is natively stored in Excel, wrap the reference to the data range with the **DATA** worksheet function.
- When a number is stored as text in Excel, an error flag may appear on the cell. If you find these flags distracting, you can turn this type of error checking off in the **Tools ▸ Options... ▸ Error Checking** pane.

Numbers

Excel stores all numbers as machine-precision doubles. A number may appear to be an integer in Excel when no decimal point is displayed, however internally the number is stored as a floating point. Whether a decimal point is displayed is a matter of formatting. See Excel Number Formats for more information.

Maximum and minimum numbers that can be natively stored in Excel are defined by machine-precision limits.

$MaxMachineNumber	1.7976931348623157*^308
$MinMachineNumber	2.2250738585072014*^-308

Excel number limits.

Outside of this range, numbers can be stored as *Mathematica* text expressions.

Dates

Excel dates are stored as numbers where the integer part represents the day and the fractional part represents the time of day.

0.0	December 30, 1899 (beginning of day)
2.0	January 1, 1900 (beginning of day)
2.5	January 1, 1900 (midday)
36 526.0	January 1, 2000 (beginning of day)
36 526.5	January 1, 2000 (midday)

How Excel stores date and time information.

What makes a number appear as a date in Excel is a matter of formatting. See Excel Number Formats for more information.

Notes

- Excel cells only format dates properly after March 1, 1900. Excel erroneously considers 1900 a leap year, and negative numbers cannot be formatted as dates in Excel.
- The `ExcelForm` function does not suffer from the same restrictions as Excel cells and can therefore be used to print out dates before March 1, 1900.

Strings

In Excel, textual data can be entered into cells specifically formatted as Text. It can also be entered into cells with other formats, such as General. *MathematicaLink for Excel* uses this formatting difference to distiguish between *text expressions* and *strings*. If a cell is formatted as Text, the content of the cell is considered to be a *Mathematica* expression; otherwise, the contents are considered to be a *Mathematica* string.

xyz (Text format)	xyz
xyz (other format)	"xyz"

Excel string mapping.

In Excel, the two versions of the string appear identical. However, there are significant behavioral differences between text cells and other cells:

Strings assigned to nontext cells pass through an Excel interpreter. The interpreter checks to see if the string being assigned appears to be a data type it knows about. If so, the string is converted to the identified data type and an appropriate cell format is automatically applied if needed.

Strings assigned to text cells do not pass through the Excel interpreter. They can therefore contain exact numbers, rationals, or anything else that can be stored as a *Mathematica* expression.

As an example, if `1/2` is assigned to a cell with the General format, the rational is interpeted as January 2 of the curent year, and a date format is automatically assigned to the cell. When `1/2` is assigned to a text cell, the fraction remains as entered.

Notes

- For worksheet functions, such as **EVAL** or **EXPR**, input ranges are *always* assumed to contain text expressions, even if the input range has not been formated as Text. This assumption makes it easy to build *Mathematica* expressions. You can wrap data ranges with the **DATA** worksheet function to treat text contained in the range as *Mathematica* strings.

Booleans

Excel Booleans are mapped to corresponding *Mathematica* symbols.

`TRUE`	`True`
`FALSE`	`False`

Excel Boolean mapping.

Errors

Excel errors are converted to *Mathematica* strings.

`#N/A`	"#N/A"
`#REF!`	"#REF!"
`#VALUE!`	"#VALUE!"
`#NULL!`	"#NULL!"
`#NAME?`	"#NAME?"
`#NUM!`	"#NUM!"
`#DIV/0!`	"#DIV/0!"

Excel error mapping.

Of these errors, four may be returned by *Mathematica* worksheet functions. In this case, the errors have the following meanings.

`#N/A`	error or empty found in inputs
`#REF!`	connection error or invalid kernel path
`#VALUE!`	evaluation returned `$Failed`
`#NULL!`	evaluation returned `$Aborted` or link was closed

Mathematica worksheet function errors.

Notes

- For worksheet functions, such as **EVAL** or **EXPR**, the #N/A error suppresses further evaluation. To force a range containing empty cells or errors to be evaluated in *Mathematica*, you can use the **DATA** function as an argument wrapper. **DATA**(*range*) is a data range that may contain empty cells or errors. You can then handle the empty values and errors in your *Mathematica* code.

Empty

Mathematica Link for Excel handles empty cells differently depending on where the cells are located.

non-trailing empty	Empty
trailing empty	trimmed from range

Excel empty cell mapping.

For empty cells to be trimmed, an entire trailing row or column within the range must contain nothing but empty cells.

Notes

- The trimming of trailing empty cells allows you to easily work with entire rows and columns of data.

Number Formats

Excel number formats allow you to define how a number will appear in your spreadsheet.

1000	General
1.0E+03	0.0E+00
$ 1,000.00	$ #,####.00
100000%	0%

Examples of Excel number formats.

Excel number formats are also used to format dates and time information that has been stored as a number.

January 1, 2000	mmmm d, yyyy
12:00	hh:mm
01-Jan-00 12:00:00	dd–mmm–yy hh:mm:ss

Examples of Excel date formats.

For more examples of Excel number formats, browse the Custom category in the **Format ▸ Cells... ▸ Number** pane in Excel.

ExcelLink Functions

ExcelActivate

`ExcelActivate[`*book*`]`
makes *book* the active book.

`ExcelActivate[`*sheet*`]`
makes *sheet* the active sheet.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelActivate[ExcelSheet["Book1","Sheet1"]]

In[3]:= ExcelContext[]
Out[3]= {Book1, Sheet1}

In[4]:= ExcelActivate["Sheet3"]

In[5]:= ExcelContext[]
Out[5]= {Book1, Sheet3}

In[6]:= ExcelActivate["Sheet1"]

In[7]:= ExcelContext[]
Out[7]= {Book1, Sheet1}
```

ExcelAddress

`ExcelAddress[`*range*`]`
returns the A1–style address of the specified range.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelAddress[{{1, 1}, {10, 3}}]
Out[2]= A1:C10
```

ExcelBook

`ExcelBook[id]`
represents a workbook identified by *id*. The *id* can be `Active`, a name, a full path, or an index.

Details

- The *id* can be one of the following:

`Active`	currently active workbook
`"Book1"` or `"Report.xls"`	the name of the workbook
`"C:\\Reports\\Report.xls"`	the full path of the workbook
`1` or `-1`	a positive or negative position index

- The first workbook opened has position `1`. The last workbook opened has position `-1`.
- Once a workbook is saved, the .xls suffix is required to identify the workbook by name or path.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelBooks[]
Out[2]= {-Book: Book1-}

In[3]:= ExcelName[ExcelBook[Active]]
Out[3]= Book1

In[4]:= ExcelNew[]
Out[4]= -Book: Book2-

In[5]:= ExcelBooks[]
Out[5]= {-Book: Book1-, -Book: Book2-}

In[6]:= ExcelName[ExcelBook[1]]
Out[6]= Book1

In[7]:= ExcelName[ExcelBook[-1]]
Out[7]= Book2

In[8]:= ExcelClose[]

In[9]:= ExcelBooks[]
Out[9]= {-Book: Book1-}

In[10]:= ExcelCheck[ExcelBook[2]]
Out[10]= False
```

ExcelBooks

ExcelBooks[ ]
gives a list of workbooks currently open in Excel.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelBooks[]
Out[2]= {-Book: Book1-}

In[3]:= ExcelNew[]
Out[3]= -Book: Book2-

In[4]:= ExcelBooks[]
Out[4]= {-Book: Book1-, -Book: Book2-}

In[5]:= ExcelClose[]
```

ExcelCalculate

ExcelCalculate[ ]
causes all formula–based calculations in Excel to update.

Details

- This function can be useful if Excel has been set to manual calculation mode or if volatile functions, such as random number generators, are being used.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelWrite["A1", "=RAND()"]

In[3]:= ExcelRead["A1"]
Out[3]= 0.0145436

In[4]:= ExcelCalculate[]

In[5]:= ExcelRead["A1"]
Out[5]= 0.0438649

In[6]:= ExcelClear["A1"]
```

ExcelCall

ExcelCall
is an internal function called by all functions that need to communicate with Excel.

ExcelCheck

`ExcelCheck[`*object*`]`
checks if *object* is valid.

`ExcelCheck[`*object*`, `*format*`"]`
checks if *object* has the specified *format*.

Details

- ■ `ExcelCheck` always returns `True` or `False`.
- ■ If *object* is a shape, the *format* can be `"Image"`, `"Text"`, or `"Other"`.
- ■ If *object* is a sheet, the *format* can be `"Work"` or `"Chart"`.
- ■ If *object* is a range, the *format* can be `"General"`, `"Text"`, a number format, or `"Mixed"`.

Examples

```
In[1]:= <<ExcelLink`
In[2]:= object=ExcelRange["Sheet1","A1"]
Out[2]= -Range: A1-

In[3]:= ExcelCheck[object]
Out[3]= True

In[4]:= object=ExcelRange["Bogus","A1"]
Out[4]= -Range: A1-

In[5]:= ExcelCheck[object]
Out[5]= False

In[6]:= object=ExcelSheet[1]
Out[6]= -Sheet: 1-

In[7]:= ExcelCheck[object, "Work"]
Out[7]= True

In[8]:= ExcelCheck[object, "Chart"]
Out[8]= False
```

ExcelClear

`ExcelClear[`*range*`]`
clears data from the specified *range* in Excel.

`ExcelClear[`*sheet*`]`
clears all data contained in the specified *sheet*.

Details

- `ExcelClear[All]` and `ExcelClear[Active]` both clear all data on the active sheet.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelWrite["A:A", $Path]

In[3]:= ExcelClear["A:A"]

In[4]:= ExcelWrite["Sheet1", Table[Random[],{1000},{10}]]

In[5]:= ExcelClear["Sheet1"]
```

ExcelClose

`ExcelClose[ ]`
closes the active workbook.

`ExcelClose[`*book*`]`
closes the specified *book*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= book = ExcelNew[]
Out[2]= -Book: Book2-

In[3]:= ExcelBooks[]
Out[3]= {-Book: Book1-, -Book: Book2-}

In[4]:= ExcelClose[book]

In[5]:= ExcelBooks[]
Out[5]= {-Book: Book1-}
```

ExcelContext

`ExcelContext[ ]`
returns a list identifying the current active context.

`ExcelContext[`*object*`]`
returns a list identifying the context of the specified *object*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelActivate["Book1"]

In[3]:= ExcelActivate["Sheet1"]

In[4]:= ExcelContext[]
Out[4]= {Book1, Sheet1}

In[5]:= object=ExcelRange["Book1","Sheet2","A1:C10"]
Out[5]= -Range: A1:C10-

In[6]:= ExcelContext[object]
Out[6]= {Book1, Sheet2}
```

ExcelDate

`ExcelDate[`*value*`]`
converts an Excel date value to a date list {*y*, *m*, *d*, *h*, *n*, *s*}.

`ExcelDate[{`*y*, *m*, *d*, *h*, *n*, *s*`}]`
converts a date list to an Excel date value.

Details

- Excel dates count days from December 30, 1899.
- Time of day information is provided by the fractional part of the date, where 0.5 represents noon.
- Excel dates can be printed in various formats using the `ExcelForm` function.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= d = Date[]
Out[2]= {2006, 7, 11, 13, 8, 48.6900112}

In[3]:= n = ExcelDate[d]
Out[3]= 38909.5
```

```
In[4]:= n // InputForm
Out[4]//InputForm= 38909.54778576389

In[5]:= ExcelForm[n,"dddd, mmm d, yyyy"]
Out[5]= Tuesday, Jul 11, 2006

In[6]:= ExcelForm[n,"h:mm AM/PM"]
Out[6]= 1:08 PM

In[7]:= ExcelDate[n]
Out[7]= {2006, 7, 11, 13, 8, 48.69}
```

ExcelDelete

ExcelDelete[*sheet*]
deletes the specified *sheet*.

ExcelDelete[*shape*]
deletes the specified *shape*.

Examples

```
In[1]:= <<ExcelLink`
In[2]:= ExcelSheets[]
Out[2]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}

In[3]:= ExcelInsert["Sheet"]
Out[3]= -Sheet: Sheet4-

In[4]:= ExcelSheets[]
Out[4]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-, -Sheet: Sheet4-}

In[5]:= ExcelDelete[ExcelSheet[-1]]
In[6]:= ExcelSheets[]
Out[6]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}
```

ExcelDialog

ExcelDialog[*type*]
displays a dialog specified by *type*.

ExcelDialog[*type*, *title*]
displays a dialog with a custom *title*.

Details

- Supported dialog types are given by $ExcelDialogs .

Examples

```
In[1]:= <<ExcelLink`

In[2]:= $ExcelDialogs

Out[2]= {Range, Open, Save, Files, Folder}

In[3]:= ExcelDialog["Range"]

Out[3]= -Range: B2:C6-

In[4]:= ExcelDialog["Open"]

Out[4]= C:\Documents and Settings\Anton\Desktop\Excel Data Types.xls

In[5]:= ExcelDialog["Save"]

Out[5]= C:\Documents and Settings\Anton\Desktop\New File.xls

In[6]:= ExcelDialog["Files"]

Out[6]= {C:\Documents and Settings\Anton\Desktop\Manager.xls,
         C:\Documents and Settings\Anton\Desktop\Temp.xls, C:\Documents and Settings\Anton\Desktop\Test.xls}

In[7]:= ExcelDialog["Folder"]

Out[7]= C:\Documents and Settings\Anton\My Documents
```

ExcelDirectory

ExcelDirectory[*name*]
gives a directory specified by *name*.

ExcelDirectory[*book*]
gives the directory of the specified *book*.

Details

- Supported named directories are given by $ExcelDirectories .
- If *book* is unsaved, its directory is given as None .

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelDirectory["Installation"]

Out[2]= C:\Program Files\Microsoft Office\Office10

In[3]:= s = ToFileName[{ExcelDirectory["Link"], "Examples"}, "Stocks.xls"]

Out[3]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Examples\Stocks.xls
```

```
In[4]:= book = ExcelOpen[s]
Out[4]= -Book: Stocks.xls-

In[5]:= ExcelDirectory[book]
Out[5]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Examples

In[6]:= ExcelClose[book]
```

ExcelFilter

ExcelFilter[*range*, {*filter*$_1$, *filter*$_2$, ...}]
applies filters to header fields in *range*.

ExcelFilter[*range*, None]
turns off all filters for the specified *range*.

Details

- The first filter is applied to the first field, the second filter to the second field, and so on.
- Filters can be value strings such as "Q4", or comparison strings such as ">100".
- If a filter is All , no filter is applied to the field at that position.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= s = ToFileName[{ExcelDirectory["Link"], "Examples"}, "Cities.xls"]
Out[2]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Examples\Cities.xls

In[3]:= ExcelOpen[s]
Out[3]= -Book: Cities.xls-

In[4]:= rng = ExcelRange["USA", All]
Out[4]= -Range: All-

In[5]:= ExcelFilter[rng, {All, "Nevada"}]

In[6]:= ExcelRead[rng]
Out[6]= {{City, State, Lat, Lon}, {Carson City, Nevada, 39.1667, -119.767}, {Elko, Nevada, 40.8333, -115.783},
         {Ely, Nevada, 39.2833, -114.85}, {Las Vegas, Nevada, 36.0833, -115.167},
         {Lovelock, Nevada, 40.0667, -118.55}, {Reno, Nevada, 39.5, -119.783},
         {Tonopah, Nevada, 38.0667, -117.083}, {Winnemucca, Nevada, 40.9, -117.8}}

In[7]:= ExcelFilter[rng, None]

In[8]:= ExcelClose[s]
```

ExcelFormat

`ExcelFormat[`*target*`]`
returns the format of *target*.

`ExcelFormat[`*target*`, `*format*`]`
sets the *format* of the target.

Details

- The *target* can be a range or a sheet.
- The *format* can be `"General"`, `"Text"`, or a number format such as `"$ #,###.00"`, `"0.0%"`, or `"yyyy-mm-dd hh:mm:ss"`.
- The *format* can also be `"AutoFit"` to adjust column widths in *target* to display all contents.
- If multiple formats exist in *target*, `ExcelFormat[`*target*`]` returns `"Mixed"`.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelFormat["A1"]
Out[2]= General

In[3]:= ExcelWrite["A1", .5]

In[4]:= ExcelFormat["A1","0.0%"]

In[5]:= ExcelFormat["A1"]
Out[5]= 0.0%

In[6]:= ExcelFormat["A1", "hh:mm"]

In[7]:= ExcelFormat["A1"]
Out[7]= hh:mm

In[8]:= ExcelFormat["A1", "General"]

In[9]:= ExcelFormat["A1"]
Out[9]= General

In[10]:= ExcelClear["A1"]
```

ExcelForm

ExcelForm[*expr*]
prints *expr* as it would appear in Excel in "General" format.

ExcelForm[*expr*, *format*]
prints *expr* as it would appear in the specified format.

Details

- The *format* can be specified using special characters such as "$ #,###.00", "0.0%", or "yyyy-mm-dd hh:mm:ss".

Examples

```
In[1]:= <<ExcelLink`

In[2]:= v = {3., 1.5*^-15, 1 / 2, 3 + 5 I, "Hello", Empty, True, False}

Out[2]= {3., 1.5×10^-15, 1/2, 3 + 5 i, Hello, Empty, True, False}

In[3]:= Map[ExcelForm, v]

Out[3]= {3, 1.5E-15, 0.5, 3 + 5*I, Hello, , TRUE, FALSE}

In[4]:= n = ExcelDate[Date[]]

Out[4]= 38909.6

In[5]:= ExcelForm[n, "dd-mmm-yy hh:mm AM/PM"]

Out[5]= 11-Jul-06 01:36 PM

In[6]:= ExcelForm[5/7, "0.0%"]

Out[6]= 71.4%

In[7]:= ExcelForm[12345, "#,### €"]

Out[7]= 12,345 €
```

ExcelGraphic

ExcelGraphic[*graphic*, *opts*, …]
specifies options for how *graphic* should be displayed in Excel .

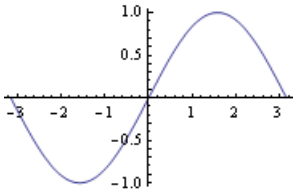
Details

- Excel [*id*] = ExcelGraphic[*graphic*, *opts*, …] displays *graphic* with specified options.
- Excel [*id*] = *graphic* displays *graphic* using default options.
- Options [ExcelGraphic] gives a list of available options.
- SetOptions [ExcelGraphic, *opts*, …] sets the defaults.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= g = Plot[Sin[x], {x, -Pi, Pi}]
```

Out[2]=




```
In[3]:= Excel["B3"] = g

In[4]:= Options[ExcelGraphic]

Out[4]= {ImageSize → Automatic, ImageMargins → Automatic,
  ImageFormat → Automatic, ImageResolution → Automatic, TextStyle → Automatic}

In[5]:= Excel["B3"] = ExcelGraphic[g, ImageFormat->"GIF", ImageSize->{400,300}, ImageMargins->20,
        TextStyle->{FontFamily->"Arial", FontSize->9}]

In[6]:= Excel["B3"] =.
```

ExcelInsert

`ExcelInsert[]`
inserts a sheet in the active book.

`ExcelInsert[`*name*`]`
inserts a sheet with the specified *name*.

`ExcelInsert[ExcelSheet[`*id*`]]`
inserts the specified sheet.

`ExcelInsert[ExcelShape[`*id*`]]`
inserts the specified shape.

Details

- The *id* can be a `"name"` or `Automatic`.
- Option `Position` can be used to specify the position where the new object is to be inserted.
- For sheets, `Position` can be an existing sheet name or index.
- For shapes, `Position` can be a {*top*, *left*} coordinate pair.
- Option `Format` can be used to specify the format of the inserted object.
- For sheets, `Format` can be `"Work"`, `"Chart"`, or a reference to an existing sheet to use as a template.
- For shapes, `Format` can be `"Image"`, `"Text"`, or a reference to an existing shape to use as a template.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelSheets[]
Out[2]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}

In[3]:= ExcelInsert[]
Out[3]= -Sheet: Sheet4-

In[4]:= ExcelSheets[]
Out[4]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-, -Sheet: Sheet4-}

In[5]:= ExcelDelete[ExcelSheet[-1]]

In[6]:= ExcelSheets[]
Out[6]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}

In[7]:= ExcelInsert["New", Position -> 1]
Out[7]= -Sheet: New-

In[8]:= ExcelSheets[]
Out[8]= {-Sheet: New-, -Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}

In[9]:= ExcelDelete[ExcelSheet[1]]

In[10]:= ExcelSheets[]
Out[10]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}
```

ExcelInstall

ExcelInstall[ ]
starts communications with Excel.

Details

- Option `Visible` specifies if a visible instance of Excel is used. The default is `Visible -> Automatic` .
- If `Visible` is `Automatic` , a visible instance of Excel must already be open to start communications.
- If `Visible` is `False` , a hidden instance of Excel is launched for private use by *Mathematica*.
- By default, `ExcelInstall[]` is called the first time communication with Excel is required.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelInstall[Visible → True]
Out[2]= LinkObject[C:\Documents and Settings\Anton\Application
          Data\Mathematica\Applications\ExcelLink\Binaries\ExcelLink.exe, 2, 2]
```

```
In[3]:= ExcelNew[]
Out[3]= -Book: Book1-

In[4]:= ExcelBooks[]
Out[4]= {-Book: Book1-}

In[5]:= ExcelClose[]

In[6]:= ExcelUninstall[]

In[7]:= ExcelInstall[Visible->False]
Out[7]= LinkObject[C:\Documents and Settings\Anton\Application
          Data\Mathematica\Applications\ExcelLink\Binaries\ExcelLink.exe, 3, 2]

In[8]:= ExcelNew[]
Out[8]= -Book: Book1-

In[9]:= ExcelBooks[]
Out[9]= {-Book: Book1-}

In[10]:= ExcelUninstall[]
```

ExcelName

ExcelName[*object*]
returns the name of the specified *object*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= objects = ExcelSheets[]
Out[2]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}

In[3]:= ExcelName /@ objects
Out[3]= {Sheet1, Sheet2, Sheet3}
```

Excel

`Excel[id]`
identifies a location to read or write from in Excel.

`Excel[id]`
reads the contents of *id*.

`Excel[id] = expr`
writes *expr* to *id*.

`Excel[id] =.`
clears the contents of *id*.

Details

- The location identified by *id* can be a range, shape, or sheet.
- The *id* can be a name, A1-style address, `All`, `Selection`, or an Excel object reference.
- Assigning graphics, typeset equations, or formatted output to a location displays a graphic.
- `Excel[id]` is equivalent to `ExcelRead[id]`.
- `Excel[id] = expr` is equivalent to `ExcelWrite[id, expr]`.
- `Excel[id] =.` is equivalent to `ExcelClear[id]`.
- `ExcelRange`, `ExcelShape`, or `ExcelSheet` can be used to create an Excel object reference.
- Excel object references can be used to provide a specific context for *id* or to specify a different type of *id*.
- Examples: `Excel[A1:C10]`, `Excel[Sheet1]`, and `Excel[ExcelSheet[1]]`.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= Excel["A1:C3"] = IdentityMatrix[3]

In[3]:= Excel["A1:C3"]
Out[3]= {{1., 0., 0.}, {0., 1., 0.}, {0., 0., 1.}}

In[4]:= Excel["A1:C3"] =.

In[5]:= data = Table[Random[], {10 000}, {10}];

In[6]:= Excel["Sheet1"] = data

In[7]:= data = Excel["Sheet1"];

In[8]:= Dimensions[data]
Out[8]= {10 000, 10}

In[9]:= Excel["Sheet1"] =.
```

ExcelNew

`ExcelNew[ ]`
creates a new workbook with the default number of sheets.

`ExcelNew[`*i*`]`
creates a book with *i* sheets.

`ExcelNew[{`*name*$_1$`, `*name*$_2$`, ...}]`
creates a book with the specified named sheets.

`ExcelNew[`*book*`.xls]`
creates a book using the specified existing book as a template.

Details

- Template names must be specified using a full path.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelBooks[]
Out[2]= {-Book: Book1-}

In[3]:= ExcelNew[]
Out[3]= -Book: Book2-

In[4]:= ExcelClose[]

In[5]:= v = Map[ToString, Range[2000, 2010]]
Out[5]= {2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010}

In[6]:= ExcelNew[v]
Out[6]= -Book: Book3-

In[7]:= ExcelClose[]

In[8]:= s = ToFileName[{ExcelDirectory["Link"], "Templates"}, "Report.xls"]
Out[8]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Templates\Report.xls

In[9]:= ExcelNew[s]
Out[9]= -Book: Report1-

In[10]:= ExcelClose[]
```

ExcelObject

ExcelObject[*type*, *id*]
represents an object of the specified *type* identified by *id* in the active context.

ExcelObject[*type*, *context*] @ ExcelObject[*type*, *id*]
provides a context for the object *id*.

Details

- All Excel objects are represented internally in this form.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= object=ExcelRange["Sheet1", "A1"]
Out[2]= -Range: A1-

In[3]:= InputForm[object]
Out[3]//InputForm= ExcelObject["Sheet", "Sheet1"][ExcelObject["Range", "A1"]]

In[4]:= object=ExcelRange["Book1", "Sheet1", "A1"]
Out[4]= -Range: A1-

In[5]:= InputForm[object]
Out[5]//InputForm= ExcelObject["Book", "Book1"][ExcelObject["Sheet", "Sheet1"][
                     ExcelObject["Range", "A1"]]]
```

ExcelOffset

ExcelOffset[*range*, {*rows*, *cols*}]
offsets *range* by the specified number of rows and columns.

Details

- `All` specifies that *range* should be offset to the end of contiguous data in that dimension.
- `None` specifies that *range* should not be offset in that dimension.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelOffset["A1", {5, None}]
Out[2]= -Range: A6-

In[3]:= ExcelOffset["A:A", {None, 5}]
Out[3]= -Range: F:F-
```

```
In[4]:= ExcelOffset["A1:C3", {1, 1}]
Out[4]= -Range: B2:D4-

In[5]:= ExcelWrite["A:A", Range[10]]

In[6]:= ExcelOffset["A1", {All, None}]
Out[6]= -Range: A11-

In[7]:= ExcelClear["A:A"]
```

ExcelOpen

ExcelOpen[*book*.xls]
opens the specified *book* in Excel.

Details

- File name book.xls must be specified using a full path.
- If it is already open in Excel, the workbook is activated.
- Newer Excel file formats such as .xlsx, .xlsm, and .xlsb files are also supported.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= dir = ToFileName[{ExcelDirectory["Link"], "Examples"}]
Out[2]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Examples\

In[3]:= files = FileNames["*.xls", dir];

In[4]:= books = ExcelOpen /@ files
Out[4]= {-Book: Cities.xls-, -Book: Highways.xls-, -Book: Metals.xls-,
         -Book: Stocks.xls-, -Book: Waves.xls-, -Book: Wind.xls-}

In[5]:= ExcelClose /@ books
Out[5]= {Null, Null, Null, Null, Null, Null}
```

ExcelOutput

ExcelOutput[*expr*, *opts*]
specifies options for how *expr* should be output in Excel.

Details

- Excel[*id*] = ExcelOutput[*expr*, *opts*, …] displays *expr* with specified options.
- Excel[*id*] = *form*[*expr*] displays *expr* in the specified form using default options.
- Options[ExcelOutput] gives a list of available options.

- SetOptions [ExcelOutput, *opts*, ...] sets the defaults.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= expr = Expand[(x + y) ^ 5]

Out[2]= x^5 + 5 x^4 y + 10 x^3 y^2 + 10 x^2 y^3 + 5 x y^4 + y^5

In[3]:= Excel["B8"] = OutputForm[expr]

In[4]:= Options[ExcelOutput]

Out[4]= {ImageSize → Automatic, ImageMargins → Automatic,
         ImageFormat → Automatic, ImageResolution → Automatic, TextStyle → Automatic}

In[5]:= Excel["B8"] = ExcelOutput[expr, ImageMargins->10, TextStyle->{FontSize->16}]

In[6]:= Excel["B8"] =.
```

ExcelPosition

ExcelPosition[*range*]
: returns the position of the top–left cell of *range* as a {*row*, *col*} index pair.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelPosition["C10"]

Out[2]= {10, 3}

In[3]:= ExcelPosition["A1:C10"]

Out[3]= {1, 1}
```

ExcelRange

ExcelRange[*id*]
: represents a range identified by *id* in the active context.

ExcelRange[*sheet*, *id*]
: represents a range in the specified *sheet*.

ExcelRange[*book*, *sheet*, *id*]
: represents a range in the specified *book*.

Details

- The *id* can be one of the following:

Selection	the currently selected range
All	all cells in the sheet
"Data_Range"	a defined range name

"A1:C10"	an A1–style address
{1, 1}	a {*row*, *col*} index pair
{{1, 1},{10, 3}}	a list of two index pairs {*top*, *left*}, {*bottom*, *right*} defining a rectangular range

- See ExcelSheet for a listing of valid *id* values for *sheet*.
- See ExcelBook for a listing of valid *id* values for *book*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelSelect[ExcelRange["A1:C5"]]

In[3]:= ExcelAddress[ExcelRange[Selection]]
Out[3]= A1:C5

In[4]:= ExcelAddress[ExcelRange[{1, 1}]]
Out[4]= A1

In[5]:= ExcelAddress[ExcelRange[{{1,1},{5,3}}]]
Out[5]= A1:C5

In[6]:= ExcelSize[ExcelRange[All]]
Out[6]= {65 536, 256}
```

ExcelRanges

ExcelRanges[ ]
gives a list of named ranges in the active sheet.

ExcelRanges[*sheet*]
gives a list for the specified *sheet*.

ExcelRanges[*book*]
gives a list of all named ranges in *book*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= s = ToFileName[{ExcelDirectory["Link"], "Examples"}, "Stocks.xls"]
Out[2]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Examples\Stocks.xls

In[3]:= book = ExcelOpen[s]
Out[3]= -Book: Stocks.xls-

In[4]:= ExcelRanges[]
Out[4]= {-Range: Stock_History-}
```

```
In[5]:= ranges = ExcelRanges[book]

Out[5]= {-Range: Stock_History-, -Range: Stock_History-, -Range: Stock_History-,
         -Range: Stock_History-, -Range: Stock_History-, -Range: Stock_History-,
         -Range: Stock_History-, -Range: Stock_History-, -Range: Stock_History-, -Range: Stock_History-}

In[6]:= ExcelContext /@ ranges

Out[6]= {{Stocks.xls, AAPL}, {Stocks.xls, ADP}, {Stocks.xls, AIG}, {Stocks.xls, BLDP}, {Stocks.xls, CSCO},
         {Stocks.xls, IBM}, {Stocks.xls, JNJ}, {Stocks.xls, MSFT}, {Stocks.xls, SYY}, {Stocks.xls, WMT}}

In[7]:= ExcelClose[book]
```

ExcelRead

ExcelRead[*range*]
reads data from the specified *range* in Excel.

ExcelRead[*sheet*]
reads all data contained in the specified *sheet*.

ExcelRead[*shape*]
reads the contents of the specified *shape*.

Details

- If *range* includes trailing empty cells, they are ignored.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelWrite["A1:C3",IdentityMatrix[3]]

In[3]:= ExcelRead["A1:C3"]

Out[3]= {{1., 0., 0.}, {0., 1., 0.}, {0., 0., 1.}}

In[4]:= ExcelRead["A:C"]

Out[4]= {{1., 0., 0.}, {0., 1., 0.}, {0., 0., 1.}}

In[5]:= ExcelRead["Sheet1"]

Out[5]= {{1., 0., 0.}, {0., 1., 0.}, {0., 0., 1.}}

In[6]:= ExcelClear["A1:C3"]
```

ExcelRefresh

ExcelRefresh[ ]
refreshes all external data queries and pivot tables in the active book.

ExcelRefresh[*book*]
refreshes the specified *book*.

Details

- External data sources can include text files, web pages, or databases.
- To set up an external data query in Excel, use the **Data ▸ Import External Data** commands.

Examples

```
In[1]:= <<ExcelLink`
In[2]:= s = ToFileName[{ExcelDirectory["Link"], "Examples"}, "Stocks.xls"]
Out[2]= C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink\Examples\Stocks.xls

In[3]:= ExcelOpen[s]
Out[3]= -Book: Stocks.xls-

In[4]:= ExcelRefresh[]
In[5]:= data = ExcelRead /@ ExcelSheets[];
In[6]:= ExcelClose[s]
```

ExcelRename

ExcelRename[*sheet*, *name*]
renames the specified *sheet*.

ExcelRename[*shape*, *name*]
renames the specified *shape*.

Examples

```
In[1]:= <<ExcelLink`
In[2]:= sheets = ExcelSheets[]
Out[2]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}

In[3]:= ExcelRename["Sheet1", "Summary"]
Out[3]= -Sheet: Summary-

In[4]:= sheets = ExcelSheets[]
Out[4]= {-Sheet: Summary-, -Sheet: Sheet2-, -Sheet: Sheet3-}
```

```
In[5]:= ExcelRename["Summary", "Sheet1"]
Out[5]= -Sheet: Sheet1-

In[6]:= sheets = ExcelSheets[]
Out[6]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}
```

ExcelResize

ExcelResize[*range*, {*rows*, *cols*}]
resizes *range* to the specified number of rows and columns.

ExcelResize[*range*, All]
resizes *range* to include all contiguous data.

Details

- None specifies that *range* should not be resized in that dimension.
- All specifies that *range* should be extended to include all contiguous data in that dimension.

Examples

```
In[1]:= <<ExcelLink`
In[2]:= ExcelResize["A1", {10, None}]
Out[2]= -Range: A1:A10-

In[3]:= ExcelResize["A1", {10, 10}]
Out[3]= -Range: A1:J10-

In[4]:= data = Table[Random[], {10}, {3}];
In[5]:= ExcelWrite["A1:C10", data]
In[6]:= ExcelResize["A1", All]
Out[6]= -Range: A1:C10-

In[7]:= ExcelResize["A1", {All, None}]
Out[7]= -Range: A1:A10-

In[8]:= ExcelClear["A1:C10"]
```

ExcelResult

ExcelResult
is an internal function used to return lengthy results to Excel .

Details

- Options [ExcelResult] gives a list of options that affect how results are returned.
- SetOptions [ExcelResult, *opts*, ...] can be used to specify these options.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= Options[ExcelResult]
Out[2]= {MaxCharacters → 255, NumberMarks → False}

In[3]:= expr = Expand[(x + .8)^9]
Out[3]= 0.134218+ 1.50995 x + 7.54975 x^2 + 22.0201 x^3 + 41.2877 x^4 + 51.6096 x^5 + 43.008 x^6 + 23.04 x^7 + 7.2 x^8 + x^9

In[4]:= StringLength[ToString[InputForm[expr]]]
Out[4]= 205

In[5]:= ExcelForm[expr]
Out[5]= 0.134218 + 1.50995*x + 7.54975*x^2 + 22.0201*x^3
          + 41.2877*x^4 + 51.6096*x^5 + 43.008*x^6 + 23.04*x^7 + 7.2*x^8 + x^9

In[6]:= SetOptions[ExcelResult, MaxCharacters → 100]
Out[6]= {MaxCharacters → 100, NumberMarks → False}

In[7]:= ExcelForm[expr]
Out[7]= ExcelResult[1]

In[8]:= SetOptions[ExcelResult, MaxCharacters → 255]
Out[8]= {MaxCharacters → 255, NumberMarks → False}

In[9]:= SetOptions[ExcelResult, NumberMarks → True]
Out[9]= {MaxCharacters → 255, NumberMarks → True}

In[10]:= ExcelForm[expr]
Out[10]= 0.13421772800000006` + 1.5099494400000009`*x + 7.549747200000004`*x^2
           + 22.02009600000001`*x^3 + 41.287680000000016`*x^4 + 51.609600000000015`*x^5
           + 43.00800000000001`*x^6 + 23.040000000000006`*x^7 + 7.2`*x^8 + x^9

In[11]:= SetOptions[ExcelResult, NumberMarks → False]
Out[11]= {MaxCharacters → 255, NumberMarks → False}
```

ExcelRun

ExcelRun[*macro*]
runs the specified VBA *macro* in Excel.

ExcelRun[*macro*, arg_1, arg_2, ...]
runs the *macro* with the specified arguments.

Examples

If the ExcelLink add-in is currently loaded in Excel, this displays the *Mathematica* Clipboard window.

```
In[1]:= <<ExcelLink`
In[2]:= ExcelRun["MathematicaClipboard"]
```

ExcelSave

ExcelSave[ ]
saves changes to the active workbook.

ExcelSave[*book*]
saves changes to the specified *book*.

ExcelSave[*book*, *book*.xls]
saves changes as *book*.xls.

Details

- If *book* has never been saved, a file name must be specified.
- File name book.xls must be specified using a full path.
- Newer Excel file formats such as .xlsx, .xlsm, and .xlsb files are also supported.

Examples

```
In[1]:= <<ExcelLink`
In[2]:= book = ExcelNew[{"Data"}]
Out[2]= -Book: Book2-

In[3]:= ExcelWrite["Data", Table[Random[], {100}, {10}]]
In[4]:= s = ToFileName[ExcelDirectory["User"], "Temporary.xls"]
Out[4]= C:\Documents and Settings\Anton\Desktop\Temporary.xls

In[5]:= book = ExcelSave[book, s]
Out[5]= -Book: Temporary.xls-

In[6]:= ExcelClose[book]
In[7]:= DeleteFile[s]
```

ExcelSelect

`ExcelSelect[`*range*`]`
selects the specified *range*.

`ExcelSelect[`*shape*`]`
selects the specified *shape*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelContext[]
Out[2]= {Book1, Sheet1}

In[3]:= ExcelSelect[ExcelRange["Sheet3", "B2:D5"]]

In[4]:= ExcelContext[Selection]
Out[4]= {Book1, Sheet3}

In[5]:= ExcelAddress[Selection]
Out[5]= B2:D5

In[6]:= ExcelSelect[ExcelRange["Sheet1", "A1"]]
```

ExcelShape

`ExcelShape[`*id*`]`
represents a shape identified by *id* in the active context.

`ExcelShape[`*sheet*`, `*id*`]`
represents a shape in the specified *sheet*.

`ExcelShape[`*book*`, `*sheet*`, `*id*`]`
represents a shape in the specified *book*.

Details

- The *id* can be one of the following:

`Selection`	the currently selected shape
`"Rectangle 1"`	the name of the shape
`1` or `-1`	a positive or negative position index

- The first shape inserted on a sheet has position 1. The last shape inserted on a sheet has position -1.
- See `ExcelSheet` for a listing of valid *id* values for *sheet*.
- See `ExcelBook` for a listing of valid *id* values for *book*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= shape1 = ExcelInsert[ExcelShape["Rectangle 1"]];

In[3]:= shape2 = ExcelInsert[ExcelShape["Rectangle 2"]];

In[4]:= ExcelShapes[]
Out[4]= {-Shape: Rectangle 1-, -Shape: Rectangle 2-}

In[5]:= ExcelName[ExcelShape[1]]
Out[5]= Rectangle 1

In[6]:= ExcelName[ExcelShape[-1]]
Out[6]= Rectangle 2

In[7]:= ExcelSelect[ExcelShape[1]]

In[8]:= ExcelName[ExcelShape[Selection]]
Out[8]= Rectangle 1

In[9]:= ExcelCheck[ExcelShape[5]]
Out[9]= False

In[10]:= ExcelDelete[shape1]

In[11]:= ExcelDelete[shape2]
```

ExcelShapes

`ExcelShapes[ ]`
gives a list of supported shapes in the active sheet.

`ExcelShapes[`*sheet*`]`
gives a list for the specified *sheet*.

`ExcelShapes[`*book*`]`
gives a list of all supported shapes in *book*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelShapes[]
Out[2]= {}

In[3]:= shape = ExcelInsert[ExcelShape["Rectangle 1"]]
Out[3]= -Shape: Rectangle 1-

In[4]:= ExcelShapes[]
Out[4]= {-Shape: Rectangle 1-}

In[5]:= ExcelDelete[shape]
```

ExcelShare

`ExcelShare[]`
starts kernel sharing with Excel on a link named `"ExcelShare"`.

Details

- You must have the *Mathematica Link* add-in loaded in Excel to share a kernel with Excel.
- `ExcelShare[]` must be called *before* connecting from Excel.
- In Excel, if your *Mathematica* Connection is set to `"Automatic"`, the *Mathematica Link* add-in will first try to connect to a link named `"ExcelShare"` and then launch its own kernel if a link with that name is not available.
- In Excel, if your *Mathematica* Connection is set to `"Shared"`, the *Mathematica Link* add-in will try to connect to a link `"ExcelShare"` and fail if a link with that name is not available.
- Anytime you close a connection from the Excel side, you need to call `ExcelShare[]` again in *Mathematica* before starting a new shared kernel session.
- `ExcelShare[]` only works in *Mathematica* 6.0 or later.

Examples

```
In[1]:= <<ExcelLink`
In[2]:= ExcelShare[]
```

Once you have connected from the Excel side, you can share definitions of data between Excel and *Mathematica*

```
In[3]:= x
Out[3]= 100
```

The above assumes you defined `x` as 100 in Excel using a formula, macro, or the clipboard.

ExcelSheet

`ExcelSheet[`*id*`]`
represents a sheet identified by *id* in the active context.

`ExcelSheet[`*book*`, `*id*`]`
represents a sheet in the specified *book*.

Details

- The *id* can be one of the following:

`Active`	the current active sheet
`"Sheet1"`	the name of the sheet
`1` or `-1`	a positive or negative position index

- See `ExcelBook` for a listing of valid *id* values for *book*.
- The first sheet in the workbook has position 1. The last sheet in the workbook has position -1.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelSheets[]
Out[2]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}

In[3]:= ExcelName[ExcelSheet[1]]
Out[3]= Sheet1

In[4]:= ExcelName[ExcelSheet[-1]]
Out[4]= Sheet3

In[5]:= ExcelName[ExcelSheet[Active]]
Out[5]= Sheet1

In[6]:= ExcelCheck[ExcelSheet[5]]
Out[6]= False
```

ExcelSheets

ExcelSheets[ ]
gives a list of sheets in the active workbook.

ExcelSheets[*book*]
gives a list for the specified *book*.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelSheets[]
Out[2]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-}

In[3]:= sheet = ExcelInsert["Sheet"]
Out[3]= -Sheet: Sheet4-

In[4]:= ExcelSheets[]
Out[4]= {-Sheet: Sheet1-, -Sheet: Sheet2-, -Sheet: Sheet3-, -Sheet: Sheet4-}

In[5]:= ExcelDelete[sheet]
```

ExcelSize

`ExcelSize[`*range*`]`
returns the size of *range* as {*rows*, *cols*}.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelSize["A1:C10"]

Out[2]= {10, 3}
```

ExcelStatus

`ExcelStatus[`*text*`]`
displays *text* in the status bar in `Excel`.

`ExcelStatus[ ]`
restores the status bar to its default state.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelStatus["Performing analysis..."];
        Pause[2];
        ExcelStatus["Generating report..."];
        Pause[1];
        ExcelStatus[];
```

ExcelTypeset

`ExcelTypeset[`*expr*, *opts*, ...`]`
specifies options for how *expr* should be typeset in `Excel`.

Details

- `Excel[`*id*`] = ExcelTypeset[`*expr*, *opts*, ...`]` displays *expr* with specified options.
- `Excel[`*id*`] = `*form*`[`*expr*`]` displays *expr* in the specified form using default options.
- `Options[ExcelTypeset]` gives a list of available options.
- `SetOptions[ExcelTypeset,` *opts*, ...`]` sets the defaults.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= expr = Expand[(α + β) ^ 4]

Out[2]= α^4 + 4 α^3 β + 6 α^2 β^2 + 4 α β^3 + β^4
```

```
In[3]:= Excel["B3"] = TraditionalForm[expr]

In[4]:= Options[ExcelTypeset]

Out[4]= {ImageSize → Automatic, ImageMargins → Automatic,
         ImageFormat → Automatic, ImageResolution → Automatic, TextStyle → Automatic}

In[5]:= Excel["B3"] = ExcelTypeset[expr, ImageFormat->"WMF", ImageSize->{300,50}, TextStyle->{FontSize->20}]

In[6]:= Excel["B3"] =.
```

ExcelUninstall

ExcelUninstall[ ]
ends communications with Excel .

Details

- Option Visible specifies if visible instances of Excel should be closed when the link is uninstalled. The default is Visible -> Automatic .
- If Visible is Automatic , visible instances of Excel are closed if no workbooks are open.
- If Visible is True , visible instances are always closed and unsaved changes to open workbooks are discarded.
- If Visible is False , visible instances are never closed.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelInstall[Visible->False]

Out[2]= LinkObject[C:\Documents and Settings\Anton\Application
          Data\Mathematica\Applications\ExcelLink\Binaries\ExcelLink.exe, 2, 2]

In[3]:= $ExcelLink

Out[3]= LinkObject[C:\Documents and Settings\Anton\Application
          Data\Mathematica\Applications\ExcelLink\Binaries\ExcelLink.exe, 2, 2]

In[4]:= ExcelUninstall[]

In[5]:= $ExcelLink
```

ExcelUnshare

ExcelUnshare[]
ends kernel sharing with Excel .

Details

- Calling ExcelUnshare[] from a *Mathematica* session is not required. There is no harm in leaving the shared link open once it is established.
- ExcelUnshare[] is automatically called when Excel closes a shared kernel session.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelShare[]
Out[2]= LinkObject[ExcelShare, 2, 2]

In[3]:= $ExcelShare
Out[3]= LinkObject[ExcelShare, 2, 2]

In[4]:= ExcelUninstall[]

In[5]:= $ExcelShare
```

ExcelWrite

`ExcelWrite[`*range*`, `*data*`]`
writes *data* to the specified *range* in `Excel` .

`ExcelWrite[`*sheet*`, `*data*`]`
fills *sheet* with *data*.

`ExcelWrite[`*range*`, `*graphic*`]`
displays a graphic at the specified *range* location.

`ExcelWrite[`*range*`, `*form*`]`
displays the expression form at the specified *range* location.

`ExcelWrite[`*shape*`, `*graphic*`]`
displays a graphic to the specified *shape*.

`ExcelWrite[`*shape*`, `*form*`]`
displays the expression *form* to the specified *shape*.

`ExcelWrite[`*shape*`, `*text*`]`
writes text to the specified *shape*.

Details

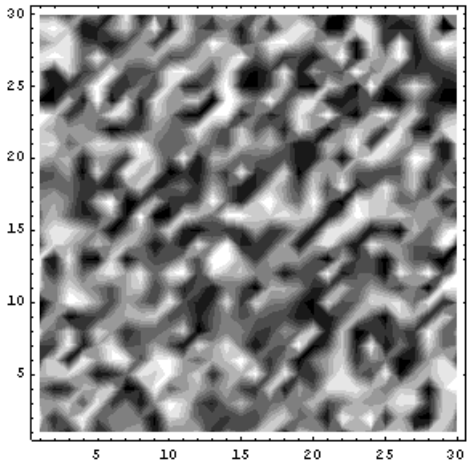
- If data does not completely fill the range, remaining cells are cleared.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelWrite["A1", 1]

In[3]:= ExcelWrite["A1:A3", {1, 2, 3}]

In[4]:= ExcelWrite["A1:C1", {1, 2, 3}]

In[5]:= ExcelWrite["A1:C3", {{1, 2, 3}, {4, 5, 6}, {7, 8, 9}}]

In[6]:= ExcelWrite["A1:C3", {{1, 2}, {3, 4}}]
```

```
In[7]:= data = Table[Random[], {30}, {30}];

In[8]:= ExcelWrite["Sheet1", data]

In[9]:= ExcelClear["Sheet1"]

In[10]:= ExcelWrite["A1", ListContourPlot[data, ContourLines → False]]
```

From In[10]:=




```
In[11]:= ExcelClear["A1"]
```

ImageFormat

`ImageFormat`
is an option to `ExcelGraphic`, `ExcelTypeset`, and `ExcelOutput`.

MaxCharacters

`MaxCharacters`
is an option to `ExcelResult`.

ToExcel

`ToExcel`
is an internal function used by the link to convert expressions into a form suitable for use in `Excel`.

$ExcelDialogs

`$ExcelDialogs`
gives a list of supported named dialogs that can be used with the `ExcelDialog` function.

Examples

```
In[1]:= <<ExcelLink`
```

```
In[2]:= $ExcelDialogs
Out[2]= {Range, Open, Save, Files, Folder}

In[3]:= ExcelDialog["Folder","Select a folder"]
Out[3]= C:\Documents and Settings\Anton\My Documents
```

$ExcelDirectories

$ExcelDirectories
gives a list of supported special directories that can be used with the ExcelDirectory function.

Details

- "Installation" is the directory where Excel is installed.
- "Home" is the default file location in Excel. This is specified in Excel under **Tools ▸ Options... ▸ General**.
- "User" is the directory where Excel user settings are stored.
- "Link" is the directory where *Mathematica Link for Excel* is installed.

Examples

```
In[1]:= <<ExcelLink`
In[2]:= $ExcelDirectories
Out[2]= {Installation, Home, User, Link}

In[3]:= ExcelDirectory /@ $ExcelDirectories
Out[3]= {C:\Program Files\Microsoft Office\Office10, C:\Documents and Settings\Anton\My Documents,
         C:\Documents and Settings\Anton\Application Data\Microsoft,
         C:\Documents and Settings\Anton\Application Data\Mathematica\Applications\ExcelLink}
```

$ExcelGraphic

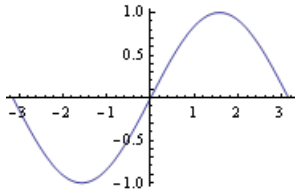
$ExcelGraphic
is an internal counter used to display graphics in Excel .

Examples

```
In[1]:= <<ExcelLink`
In[2]:= $ExcelGraphic
Out[2]= 0
```

```
In[3]:= g = Plot[Sin[x], {x, Pi, -Pi}]
```

Out[3]=




```
In[4]:= ExcelForm[g]
Out[4]= ExcelGraphic[1]

In[5]:= $ExcelGraphic
Out[5]= 1
```

$ExcelLink

`$ExcelLink`
gives the `LinkObject` being used to communicate with `Excel`.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= $ExcelLink

In[3]:= ExcelInstall[]
Out[3]= LinkObject[C:\Documents and Settings\Anton\Application
          Data\Mathematica\Applications\ExcelLink\Binaries\ExcelLink.exe, 2, 2]

In[4]:= $ExcelLink
Out[4]= LinkObject[C:\Documents and Settings\Anton\Application
          Data\Mathematica\Applications\ExcelLink\Binaries\ExcelLink.exe, 2, 2]

In[5]:= ExcelUninstall[]

In[6]:= $ExcelLink
```

$ExcelOutput

`$ExcelOutput`
is an internal counter used to display formatted output in `Excel`.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= $ExcelOutput
Out[2]= 0
```

```
In[3]:= expr = BaseForm[10, 2]
Out[3]//BaseForm= 1010₂

In[4]:= ExcelForm[expr]
Out[4]= ExcelOutput[1]

In[5]:= $ExcelOutput
Out[5]= 1
```

$ExcelResult

$ExcelResult
is an internal counter used to return lengthy results to Excel .

Examples

```
In[1]:= <<ExcelLink`

In[2]:= $ExcelResult
Out[2]= 0

In[3]:= expr = Expand[(x + 2) ^ 100];

In[4]:= ExcelForm[expr]
Out[4]= ExcelResult[1]

In[5]:= $ExcelResult
Out[5]= 1
```

$ExcelShare

$ExcelShare
gives the LinkObject being used to share a kernel session with Excel.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= ExcelShare[]
Out[2]= LinkObject[ExcelShare, 2, 2]

In[3]:= $ExcelShare
Out[3]= LinkObject[ExcelShare, 2, 2]
```

$ExcelTypeset

`$ExcelTypeset`
is an internal counter used to display typeset equations in Excel.

Examples

```
In[1]:= <<ExcelLink`

In[2]:= $ExcelTypeset

Out[2]= 0

In[3]:= expr = TraditionalForm[Expand[(x + 1 / 2) ^ 5]]

Out[3]//TraditionalForm=
```

$$x^5+\frac{5\,x^4}{2}+\frac{5\,x^3}{2}+\frac{5\,x^2}{4}+\frac{5\,x}{16}+\frac{1}{32}$$

```
In[4]:= ExcelForm[expr]

Out[4]= ExcelTypeset[1]

In[5]:= $ExcelTypeset

Out[5]= 1
```